RADIO CONTROL MODELS & ELECTRONICS

FULL SIZE PLANS FOR A FLYING BOAT + MULTI RIGGING + R/C YACHT

JULY 1965

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U.S.A. & Canada 50 cents

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MAP HOBBY MAGAZINE

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Slimline Superhet Rx. 7.2 volt operation. Size only 3" x 1⅞" x 1". Wt. 3 oz. Transmitter all transistor. 12v. DEAC. Twin modulators. Xtal controlled. R.F. meter. Half watt output. Tx **£42.** Rx **£26.** COMPLETE OUTFIT **£68**

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R.C.S. Sports 10 Outfit Mk II

Slimline Super-regen Rx. 7.2 volt operation from servo DEAC supply. Size only 3" x 1⅞" x 1". Wt. 3 oz. Transmitter as for Competition 10.

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(WITH Mk. II REED UNIT)

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(SUPER POWER TX)

Slimline Super-regen Rx as above but with 6 Ch. Reed Bank. New design Tx. ½ watt output. **£38**

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(SUPER POWER)

As above. **£38**

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(FOR BONNER SERVOS) £3.8.0

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All transistorised. Single channel. Xtal controlled. Half watt output Tx. 12 volt operation. New design Rx with quick blip facility for motor control. Rx **£8.** Tx only **£9.** Complete **£16**

ACCESSORY OUTFIT. Consists of new Elmic Compact compound escapement, wiring harness, battery box, switch, allows immediate operation. **£4.10.0**

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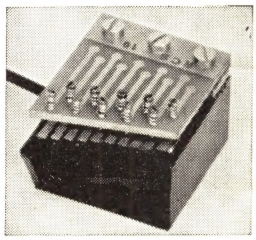

R.C.S. 10 Reed Bank Mk. II

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RADIO CONTROL MODELS & ELECTRONICS

JULY 1965

VOLUME 6 NUMBER 7

MAP HOBBY MAGAZINE

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NEXT MONTH . . .

Highlights of the issue include :

SPECIAL GALLOPING GHOST Tx & Rx BOOKLET

SLAVE RELAYS

BRITISH NATIONALS REPORT

PYLON RACER SKETCHES

TEST REPORTS

COMMERCIAL DEVELOPMENTS

GADGETS & GIMMICKRY

Plus the usual favourites

CORRESPONDENCE anticipating a reply to addresses within the United Kingdom, must be accompanied by a stamped and self-addressed envelope. Photographs should be accompanied by negatives where possible and can only be accepted for use on an exclusive basis for British copyright.

CONTENTS

HERE, THERE & EVERYWHERE 300

COTSWOLD Rx 301

THE RIGHT ANGLE 304

2 WIRE SERVOS 306

STEERING CIRCUIT FOR BOATS ... 307

GADGETS & GIMMICKRY 308

"SIZE 9"
FULL-SIZE PLAN FOR A FLYING BOAT ... 310

Tx AERIAL EFFICIENCY 315

R/C YACHT 318

SINGLE TRANSISTOR STABLE TONE GENERATOR 320

DYNAMIC BRAKING 322

TEST REPORTS
FUTABA Tx & Rx, MODELECTRIC "MINI-MOD", GRUNDIG SUPERHET 324

COMMERCIAL DEVELOPMENTS ... 327

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R/C ENGINES

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- Compact 6 Volt Designs, in Unbreakable Anodised Hardened Dural Case
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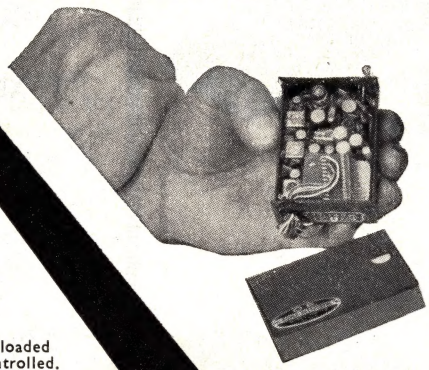
- O.S. Custom Built Craftsmanship . . . By any comparison the World's Best.



O.S. PIXIE

Single Channel Transmitter and Relay Reciever

£16.15.0

FEATURING

- Guaranteed out-of-sight range.
- Guaranteed Temperature Stability.
- Transmitter & Receiver both operate off 9 volts.
- Transmitter has centre loaded aerial and is crystal controlled.
- Receiver has nylon case, weighs 1¼ ozs. and includes a relay.
- Receiver is suppressed for electric Servo use.

OUTSTANDING ALL TRANSISTOR DESIGN WITH A MIGHTY PERFORMANCE!

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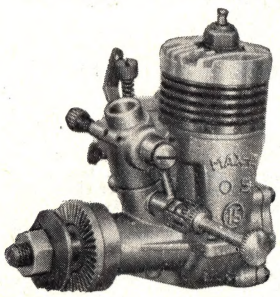
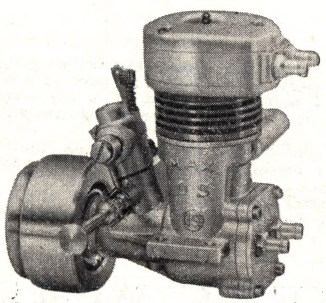
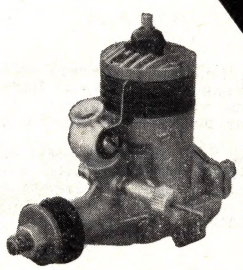


MAX 15 R/C...**169/5d.**
MAX 19 R/C...**169/5d.**
MAX 29 R/C...**160/7d.**
MAX 30 R/C...**176/3d.**
MAX 35 RC...**162/11d.**
MAX 40 R/C...★
MAX 49 R/C...**228/9d.**
MAX 50 R/C...**275/4d.**
★ To be announced



MAX 19 R/C MARINE
275/4d.



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K.1 Compound ...	£2	16	3
K.2	£2	9	1

O.S. SERVOS

(Single Channel)
S-101 Rudder Servo
£3 4 6

S-101M Motor Servo
£2 17 6

TRANSISTORS

AC127	9/6	OC44	6/-
AC107	12/6	OC45	4/-
AF114	9/-	OC70	4/-
AF115	8/6	OC71	4/-
AF116	8/-	OC72*	6/-
AF117	6/-	OC75	6/-
AF118	17/6	OC76	6/-
AF124	10/-	OC81*	6/-
AF125	10/6	OC82*	9/-
AF127	9/6	OC83*	6/-
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GET115	9/6	OC169	6/-
GET116*	15/-	OC170	7/6
GET880	12/6	OC171	8/6

*Matched pairs available.

BRAND NEW 1st GRADE MULLARD TYPES

DIODES		Power Transistors	
OA70	2/6		
OA79*	3/-		
OA81	2/6		
OA90	2/6	OC22*	17/6
OA91	2/6	OC23*	17/6
OA95	3/6	OC24*	25/-
		OC25	12/-
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ORP60	5/-	OC28*	17/6
2N502	19/6	OC29*	17/6
AF186	27/6	OC35*	15/-
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ACY17	10/-	AD140*	19/6
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ACY19	9/-		

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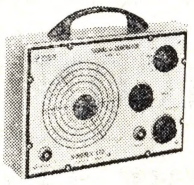
★ NOMBREX TRANSISTORISED RESISTANCE CAPACITANCE BRIDGE

1 pF to 100 mfd. 1 ohm to 100 meg., leakage test, visual null indicator. **£8.5.0d.** with batt.

NOMBREX TRANSISTORISED INDUCTANCE BRIDGE £18

TRANSISTORISED PORTABLE TEST EQUIPMENT

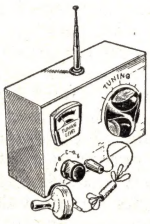


★ NOMBREX AUDIO GENERATOR. 10 to 100,000 c/s Sine/square. **£16:15.0d.** with batt.

★ NOMBREX TRANSISTORISED POWER SUPPLY UNIT. 1 to 15 v. D.C. up to 0.1 amp. 230/250v. A.C. mains. **£6.10.0d.**

★ NOMBREX ALL TRANSISTOR SIGNAL GENERATOR. 150 kc/s to 350 mc/s. AF, RF Mod., etc., **£9.10.0d.** with leads, batt., etc.
Post and Packing 2/6d. any type ● Detailed Leaflets on request.

FIELD STRENGTH METER



Fitted 200 μA meter. Calibrated scale, telescopic aerial, checks CW output from Tx, also earphone for audio or modulation. Covers 1 to 250 mc/s. **IDEAL FOR 27 mc/s.**

59/6d.

Post 1/6d.

MINIATURE CONDENSERS

All popular values from 1pf-5000pf at **6d.** each, 5% types **9d.** each.

MOTOR Size 1⅞" x 1". Eveready 4/9v. **7/6**

BRAND NEW VALVES FOR RADIO CONTROL

DK96 8/-; 6C4 5/-; 3S4 (DL92) 5/-; 3A5 (DCC90) 7/-; 1S4 (DL91) 5/-; 3V4 (DL94) 6/-; 3D6 (1299A) 4/6; XFY34 15/-; DL68 5/-; 3A4 4/-. XFG1 17/6. Bases at 9d. each.

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Complete with fittings

LA1	12/6	LA9	17/6
LA2	15/-	LA10	17/6
LA3	19/6	LA2503	15/-
LA4	12/6	LA2504	15/-
LA5	17/6	LA2505	17/6
LA6	22/6	FX1011	6/-
LA7	19/6	LA45	15/-

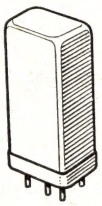
RADIO CONTROL CRYSTALS

American 27.255 mc/s 3rd overtone. Lightweight, wire end for valve or transistor circuits. Only 15/- each. 9.065 mc/s Third Overtone Crystal for Valve Circuits 12/6, Holder 1/-.

NEOSID CORES **6d.** each

Miniature 27 mc/s R.F. Chokes **1/6d.**

SIEMENS



(HIGH SPEED RELAYS)

500– 500 ohms
1000–1000 ohms
1700–1700 ohms
All 1 pole 2-way contacts.
Size 2 x 1 x ½".

15/- each

RELAYS

12v. 700 ohm 4p2w **15/-**
12v. 700 ohm 20 mA. 2p2w **7/6**
12/24v. 250 ohm 2p2way **7/6**
15v. 6000 ohm 1p2way **12/6**

"WHIT 63"

All parts available for this Rx. S.A.E. with list please for quote.

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D1001 5:1 Interstage ½ x ⅜ x ½
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D240 8½:1 ditto
TP9A All at **8/-** each.
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Potted version of above **7/-**
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*LT700 ,, Output to 3 ohms **4/6**
*8/- pair.

Sub Miniature Multiway Plugs/Sockets **5/-** pair. 7 pin Cadmium plated. Ideal for all Radio Control units.

VALVES, TRANSISTORS QUARTZ CRYSTALS, RECTIFIERS & ZENER DIODES Send for list of 1,500 types **1/-**

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Kits of Parts		Assembled Versions
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★ Ivy-A/M Carrier Receiver Mk. II	£3.10.0	20/- extra
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★ Terrytone Mark II Tone Receiver	£5.19.6	30/- extra
Metal Instrument Case & Aerial	£3. 9.6	

Each kit contains selected and tested top-quality components, finished printed circuit or tag board, etc., super detailed step-by-step assembly instructions, solder, etc., etc.

READY ASSEMBLED AND TESTED EQUIPMENT

"MINIMAC" 5-Transistor Relayless Receiver. Size 1¾ x 1". Weight ¾ oz. **£8.19.6d.**

ALL TRANSISTOR TRANSMITTER. Crystal controlled. Unrivalled in performance and reliability! Size 7 x 6½ x 1¾". **£10.19.6**

CONVERTOR-MODULATOR Tx. Economic TONE or CARRIER transmitter. 9 volts. **£8.19.6d.**

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50-0-50 microamps (5B305) **25/-**
*0-200 microamps **69/6**
*0-1 milliamps **59/6**
*3 x 1 x 3½"
Send for list of PANEL METERS

TINYTONE RECEIVER

All transistor receiver as described in December 1964 edition of R.C.M. & E. Total cost of all specified parts including ready drilled and etched printed circuit board (7/6d.): **59/6d.** + postage 1/-.

5 TRANSISTOR V.H.F. RECEIVERS

Complete with (5) V6/8R = OC44 Transistors, 2 OA91 Diodes, OA10 Rectifier with built in DEAC Re-charging Circuit for 3.9v. 450 m/a DEAC.

Complete as above with circuit **BRAND NEW**

12/6 ea.

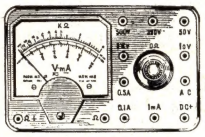
+ post 1/6

"An Unrepeatable Bargain"

INEXPENSIVE TEST GEAR (Multi-Range Testmeters)

A MUST FOR EVERY ENTHUSIAST !

Model		
PT34 (illus.)	1k ohms per volt	**39/6**
THL33	2k ,,	**75/–**
EP10K	10k ,,	**79/6**
ITI-2	20k ,,	**89/6**
TP55	20k ,,	**£5.19.6**
500	30k ,,	**£8.19.6**



For measuring VOLTAGE, RESISTANCE, CURRENT & CAPACITY. All types supplied with full instructions, test leads and battery. Descriptive leaflets available on request.

RESISTANCE SUBSTITUTION BOXES

Provides 24 accurate values for Circuit Substitution :
15 ohm – 10k 1 watt.
15k – 10 meg. ½ watt.
4 x 2½ x 1½". **32/6,** post 1/6.

CAPACITANCE SUBSTITUTION BOXES

For accurate selection of 9 standard values. 600v. Condensers. Just switch to required value ! 4 x 2½ x 1½". **22/6,** post 1/6.

PRINTED CIRCUIT ETCHING KIT

Supplied complete with all chemicals, brush and dish, full details and 3 Boards 6 x 3". 19/6, pp. 1/6.
Spare Boards 1/8 ea. 6 x 6" Boards **3/6.**

SUB-MINIATURE 465/470 Kc/s IFs

Size only ⅞ x ½ x ½" 3/- each or 10/- set of 4 with O.S.C. Coil.

10 m/m ⅜ x ⅜ x ½ Version at 15/- set of 4 with O.S.C. Coil.

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Miniature from : 1MFD 1/6d. each to 100MFD. Sub-Min. to 100MFD **1/9** each.

SOLDERING IRONS

220/250v. Mains

Antex*	15 watt (⅜" bit)	**29/6**
Solon	15 watt (¼" bit)	**22/–**
Eagle	30 watt (¼" bit)	**14/6**
Solon	25 watt (⅜" bit)	**24/–**

*Also 12 volt versions at **24/6** plus post 1/-.

NEW EDITION 1965
90 page **CATALOGUE**
2/6 post paid

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All Preferred Values
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5% Hi-Stab Sub-Min. 6d.

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A. 3¼" closed; 14" ext. **3/6**
B. 8¼" closed; 38½" ext. **6/6**
C. 6" closed; 38" ext. **10/6**
D. 8" closed; 64" ext. **17/6**
E. 7" closed; 25" ext. **4/6**

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We are able to supply most of the components specified in this magazine let us quote for your circuit. S.A.E. with list please.

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303 EDGWARE RD., LONDON, W.2

PAD 1008/9 **DEPT. 'A'**

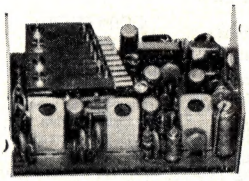
Shop Mon.-Sat. 9-6 p.m.; Thurs. 9-1 p.m.

'The Component and Equipment Specialists'

Trade Enquiries Invited

MULTI CHANNEL RADIO CONTROL EQUIPMENT
by
REMCON ELECTRONICS LTD.

THE REMCON SUPERHET RECEIVER
for Multi Channel Applications



The Rx you can build for £8.17.6 plus bank and crystal

Superhet receivers are used when it is necessary to operate more than one model simultaneously. Superhets are more complex than superegen receivers and the REMCON Superhet has been developed especially for the home constructor and to avoid the need for elaborate test equipment.

The REMCON receiver is all transistor and designed to operate on 6 volts from the servo battery pack. It is intended for use with a good quality reed bank, of 40 ohm. to 90 ohm. resistance, having up to 12 reeds. Adequate space is provided for any currently available reed bank.

The receiver is available as a complete pack of components. The printed circuit board has been carefully laid out to permit ease of construction of this compact receiver. The board is accurately drilled, and the tuning coil is ready wound. All the necessary components are provided (with the exception of crystal and reed bank), and include a strong light box, which is anodised and decorated, transistor solder, grommets, and flexible wire, and the I.F.T.'s are approximately aligned.

The overall size of the receiver is 2⅞" x 1⅝" x 1¼" and all wires pass through the sides of the box so that the receiver requires minimum of space when installed.

It is essential that the transmitter and receiver contain matched crystals, and that the lower frequency crystal is used in the receiver. Crystals are stocked to six spot frequencies within the U.K. permitted band width of 26.995 to 27.255 Mc/s.

THE REMCON PLEDGE *We undertake to make operational, at reasonable cost, Remcon Twelve Transmitters and Remcon Superhet Receivers completed from our parts.*

REMCON TWELVE TRANSMITTER
For Single and Multi Channel Applications

An all transistor crystal controlled transmitter for single or bi-simultaneous tone transmission of up to twelve channels for use with superhet or superegen receivers.

Range and tone stability are excellent and achieved only by optimised design of circuitry and use of carefully matched components of the latest type.

REMCON TWELVE PRICES:

INSTRUCTION MANUAL	2/6
EIGHT TRANSISTOR PACK	78/-
RESISTOR-CONDENSER PACK (includes hi-stab resistors)	63/-
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ANODISED, ALUMINIUM, DECORATED CASE	39/6
CHROME TELESCOPIC AERIAL CENTRE LOADED	37/6
SUPER LIGHT ACTION SWITCHES: On/Off ea. ... 10/- Biased ea. ...	11/6
WIRE WOUND SLIDERS (one per chan.) ea.	2/6
CRYSTALS: NOMINAL 27 mc/s ... ea.	26/-

Note. Nominal crystals cannot be matched for s/het operation.

REMCON SUPERHET RECEIVER

PRICE ALL COMPONENTS	£8.17.6
CONSTRUCTIONAL DETAILS ONLY ...	3/-
RECOMMENDED REED BANKS:	
12 CHANNEL ...	£9.19.6
10 CHANNEL ...	£8.17.6
SUPERHET CRYSTALS — matched pairs	£2.17.6
REMCON TRANSIMATIC AMPLIFIER for Duramite servos. Complete Kit	57/6
MERCO ENGINES FOR R.C. 49:	£11.19.6
61:	£12.17.3
REMCON MERCO MARINE CONVERSION: Cooling Head, Flywheel, Muffler and Exhaust Pipe	£5.19.6
Cooling Head and Flywheel	£3.19.6
MINIATURE TOGGLE SWITCH. Totally enclosed. Weight 3 grams. 3 pole changeover.	Each 19/-

SERVOS — TRANSMITE — MUSCLEMITE — REMCON — MAXAMITE.

STAMP FOR BROCHURE — OR CALL AT 4a AND SEE OUR RANGE.

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Larkhill
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Kraft 10 Tx & Rx	£25
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Metz Universal Tx & Rx	£13
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C & S 511 Relayless Rx	£5
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Merco 49 8c.c. Glow	239/-
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88A
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Calibrated on 27 mcs. **90/-**

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★ All previous features fully retained.

See R.C.M. & E. July report of gain of 5 with these aerials.

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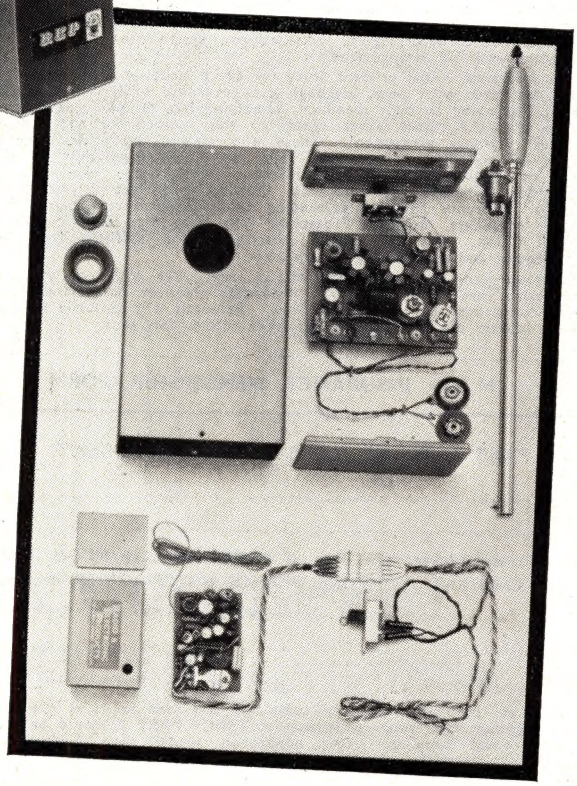

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This transmitter is transistorized and crystal controlled for high stability. The unit is light to handle and the alloy case is in an attractive anodised finish.

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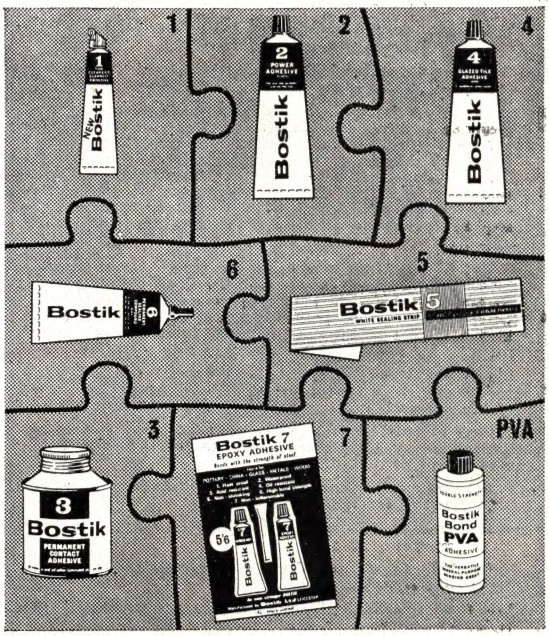

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Gives the strongest bond of any 'Bostik'. Can withstand almost 1,000 lbs. per sq. in. Use it for metal, wood, glass, china and other materials. Complete with own mixing and spreading spoon.

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White, all-purpose adhesive. Easy to use, quick to bond. Particularly powerful joining wood to wood.

Bostik

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(a) accidental bodily injury to any person (whether or not death results).

(b) accidental loss of or damage to property.

occurring during the Period of Insurance within the limits of Great Britain, Northern Ireland, the Channel Islands or the Isle of Man and arising out of and in the course of the use of any of the undermentioned type models through the fault or negligence of the Holder and/or any person acting on his behalf or for whom he may be responsible or by any defect in any such model.

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(1) Model Aircraft powered by either rubber motors, internal combustion engines of petrol or diesel type or machines of the Glow Plug type or machines operated by expansion engines or propelled electrically. Excluding any kind of rocket of pulse jet unit other than "Jetex" power unit.

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(b) Free flight—Total engine capacity up to but not exceeding 10 c.c.

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(i) caused by models sold or supplied by the Holder.

(ii) of passengers in or on any model.

(3) In the event of an accident liability must not be admitted by the Holder nor must the existence of this insurance be mentioned.

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This insurance is the prudent thing for every modeller to take out, but it is a sad fact that until now, although the governing bodies of the hobby have offered this cover to their members, something like 90 per cent of the modellers in the U.K. have never taken up this opportunity and are operating 'without insurance protection'. Those who wish to make the most of flying and other modelling opportunities must be insured not only for their own peace of mind—accidents do sometimes happen—but also because Local Authorities, Ministers and others are showing an increasing awareness of this need for insurance and are demanding proof of adequate cover. By joining M.A.P. 'Modellers' Accident Protection' you come into the worlds's BIGGEST MODEL CLUB. For your initial subscription you obtain a lapel badge for identification and transfers to put on your model.

Complete your form and send off at once. We will send you back your membership card, lapel badge and waterslide transfers immediately. Insurance period commences on 1st January 1965. Renewals will normally be made from nearest quarter day, and renewal reminder notices duly sent.

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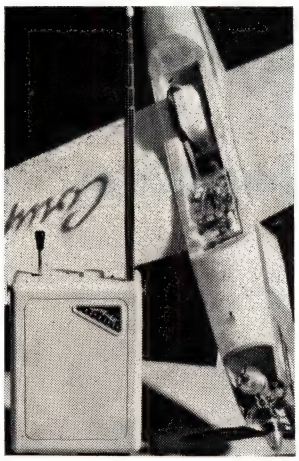
ANNOUNCE

THE NEW 2 CHANNEL EQUIPMENT



2 CHAN.—TUNED FILTER—
2 POSIT. STICK CONTROL
Offers the Safest Approach to Single Channel Radio Control.

- NO TUNING
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- COMMON 6v. SOURCE
- 2 U2 CELLS FOR Tx
- LIGHTWEIGHT Rx

GIFT SET WITH SERVO

£38.10.0

CHECK THE REVISED PRICES FOR THE METZ RANGE

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6 Chan. S/Het Rx	£50	0	0
4 Chan. Adapter	£20	0	0
2 Chan. Servo	£5	6	0
*10 Chan. Outfit	£150	0	0
*6 Chan. Outfit	£119	8	0
3 Chan. Transmitter	£23	0	0
3 Chan. Rx	£27	10	0
*3 Chan. Outfit	£60	10	0
5/2 Tx Converter	£8	4	0
5/2 Rx Converter	£13	0	0
*5 Ch. Conv. & Servo	£26	10	0

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S/Chan. Baby Rx	£11	10	0
*Baby Gift Set	£29	19	6
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2 Chan. Receiver	£16	9	6
*2 Chan. Set	£38	10	0
Single Chan. Servo	£4	14	0
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Here. There and Everywhere

Steady On!

LITTLE did we realise how many designers would rally to the call of a reader's problem last month. . . . Many solutions were similar, but all have been passed to the designer in question. If we were to publish every one, it would take an issue of *R.C.M. & E.* so, on the basis of the first idea received, worthy of publication for the majority of our readers (and there were many so worthy), we have scheduled one for publication.

Correction

"Temperature Stability of Tuned Filters", June issue.

We must apologise for the following errors in the 3rd and 4th lines from the bottom of the first column. The sentence should read: Now the tuned frequency = $\frac{1}{2\pi\sqrt{LC}}$ i.e., frequency $\propto$ (proportional to) $\frac{1}{\sqrt{LC}}$

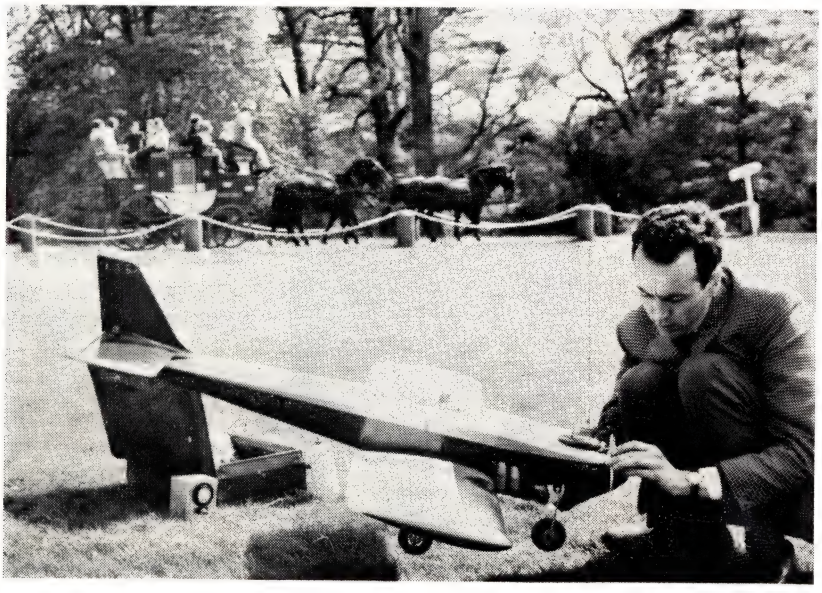
Under the heading "Variation of Filter Circuit". There is a letter wrong in the 9th line which should read: "difference, V_{be}, between Base and emitter.

The Cover

Scale enthusiast, model specialist Dave Platt displays his R/C Miles Magister which also appears in our heading photograph. The shots were taken when he visited the offices before the Nationals R/C event, a report on which will appear next month.

Latest Fixtures

July	4	Hull Model Boat Contest. Previously dated July 3rd (Sunday).
July	11	Chester M.A.C. R/C Single Surface, R/C Multi, West Slopes of Moel-Ffamau, nr. Mold. Pre-entry for R/C required by 1.7.65. (Rules as 1964). 2/- Senior. 1/- Junior. Enquiries and entries to: C. R. Filtness, 26 Raymond St., Chester.
July	25	Bristol R/C M.A.C. Rally; Multi, scale and Intermediate 6 or less event. The scale will have a limited aerobatic schedule, intermediate will be on the basis of a spot landing and nominated time. Competition flights start 10 a.m., prizes of £5, £3, and £2 in scale and multi which will be flown simultaneously.



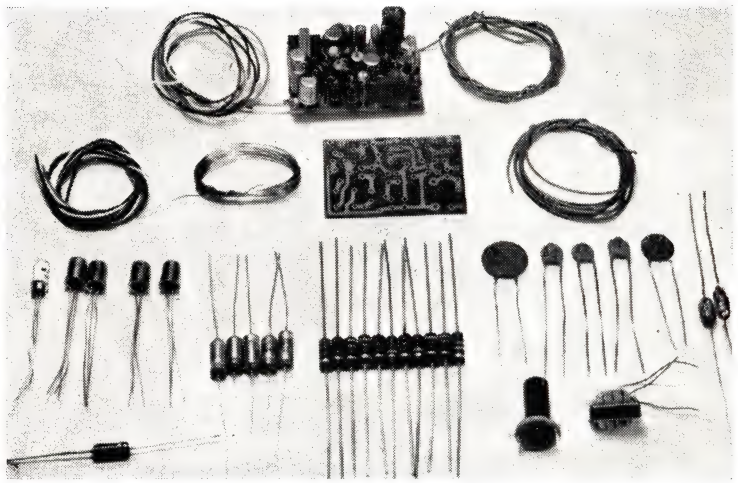
Above : "Runway borer's" view of the Platt Magister, our office tennis court was too small for demonstration.

Left electronics and stage coaches . . . this shot was taken at a recent demonstration session at Woburn Abbey organised by R.C.S. It will be noted that the flying area is now farther up the hill. Our picture shows D. Burt with one of the demonstration machines. He was using R.C.S. Comp. 10 and a Servomite pack. . . . Not one of the horses' eyelids batted as the models hurtled past. Full-size and static models on display were also a potential crowd puller.

The Cotswold

RELAYLESS S/C SUPER REGEN RX

By B. E. RUSSELL



THE Cotswold is a single channel, five transistor super-regen receiver, developed over the past year to provide a sensitive and reliable set, easily assembled by the home constructor.

Extensively tested in the field, and utilising a variety of actuator systems, it has an excellent record of trouble-free performance and gained full marks after testing by Eric Hill. The circuit is based on one of Malcolm Douglass' receiver front ends to which is added a standard output stage. There is no question of 'if this doesn't work try something else' or 'adjust for best sensitivity': properly assembled, the receiver should work first time without any difficulty.

The receiver is illustrated in two sizes: the standard version, supplied as a complete kit by Messrs. Harrogate Radio Co., and the miniature—a little smaller than the Otarion—to be sold already assembled by Messrs. Dunn's Art Stores, 35 Scott St., Perth.

The Cotswold operates on voltages from 3 v. to 4.8 v. and only one battery is required for receiver and actuator. The use of DEAC cells is strongly recommended. Any tone transmitter with modulation frequency between 400 and 600 c.p.s.—a Tommytone or similar valve Tx gives a ground range of 400-500 yds. more than adequate for those who actually like to see which way their model is pointing!

Assembly and Testing

These notes apply to receivers built from the kit. For those who prefer to make their own p.c. boards the techniques have been well covered in this magazine.

If you have not attempted to build equipment as small as this before, it is strongly recommended that you practice soldering with a suitably drilled piece of p.c. board and scrap component leads. For an efficient soldering job you will require: a really hot clean iron, the right gauge of solder (22 s.w.g. in this case), clean components leads and simultaneous application of iron and solder, quickly, to make the joint. As the components are closely mounted and must be inserted the right way round, it is advisable to identify them carefully and examine the layout before starting assembly. There is insufficient room to use a heat shunt on transistor leads but if you follow the sequence suggested and on no account linger with the iron, no damage should result.

Begin by bending component leads and cut to length as shown in Fig. 4. Carefully study the colour coding and make sure that you have the right component in the right place. The board is pre-fluxed and must *not* be cleaned off. Tick off each operation, within the brackets, as completed.

Check Here

( ) Carefully bend up the solder tags of the coil former 90 deg., bare end of 28 s.w.g. e.c.w., solder to one tag. Wind on 9½ turns, bare end, solder to the other tag.

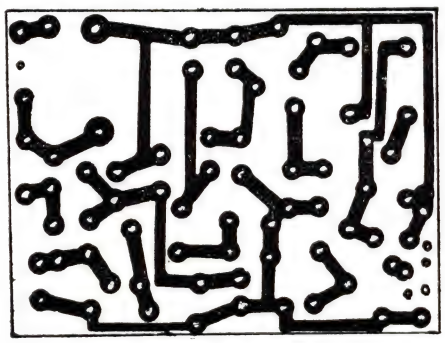


Fig. 1

( ) Bend leads of 22 pf capacitors as shown in Fig. 5, solder to former tags, so that with the former mounted, the bottom of the coil is nearest the board edge.

( ) Insert former pins in 1 and 2, solder.

( ) Insert 2.5 pf capacitor in 31 and 32, solder.

( ) Insert 10 pf capacitor in 33 and 34, solder.

( ) Insert RFC in 38 and 39, component over 38, solder.

( ) Insert 3.3K resistor in 6 and 7, component over 7, solder.

( ) Insert 3.3K resistor in 4 and 5, component over 5, solder.

( ) Insert 6.4 μf capacitor in 47 and 48, negative end over 47, positive lead in 48. solder.

( ) Insert 6.8K resistor in 18 and 19, component over 19, solder.

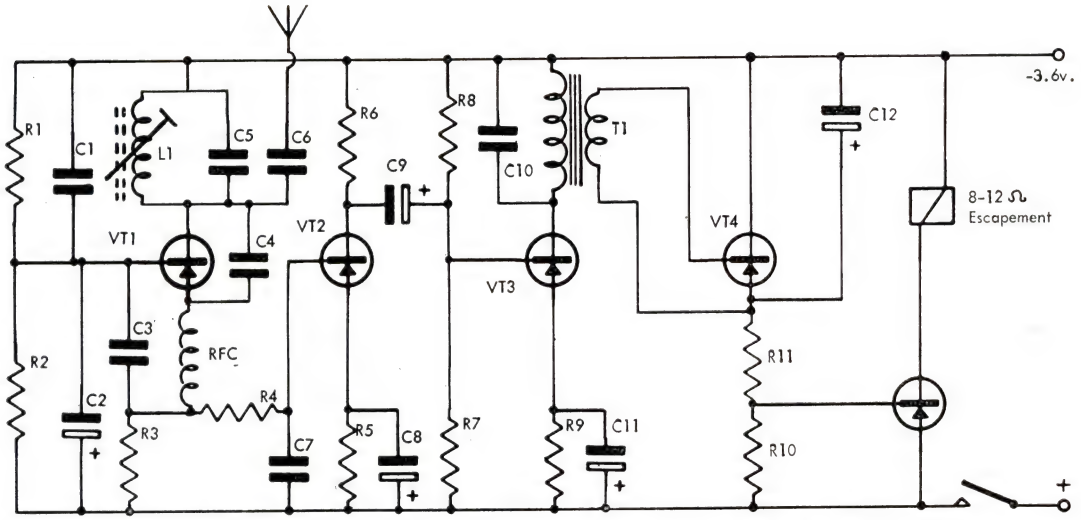
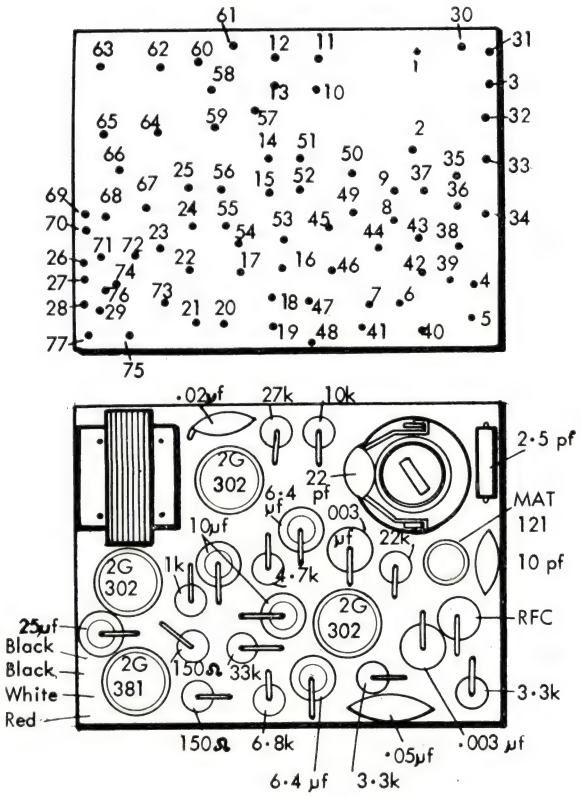


Fig. 2. Theoretical Circuit

Fig. 3. Hole Identification and Placement. (Hold up to the light to identify.) Drawings are enlarged, P.C. shown full size in Fig. 6.



COMPONENT LIST

Resistors

½ watt 10 per cent tolerance.

R1 : 22K red/red/orange/silver.
R2 : 6.8K blue/grey/red/silver.
R3 R4 R5 : 3.3K orange/orange/red/silver.
R6 : 10K brown/black/orange/silver.
R7 : 4.7K yellow/violet/red/silver.
R8 : 27K red/violet/orange/silver.
R9 : 1K brown/black/red/silver.
R10, R11 : 150 ohms brown/green/brown/silver.

Capacitors

Mullard Electrolytic (value marked on component).

C2, C9 : 6.4 μf, 25 v. wkg.
C8, C11 : 10 μf, 16 v. wkg.
C12 : 25 μf, 4 v. wkg.

Capacitors
Radiospares Disc, 30 v. wkg.
C7 : .05 μf.
C10 : .02 μf.

Capacitors
Erie discs.
C4 : 10 pf.
C5 : 22 pf.

Capacitors
Erie tubular.
C6 : 2.5 pf.

Capacitors
Tubular Hunts 500 v. wkg.
C1, C3 : .003 μf.

( ) Insert 22K resistor in 8 and 9, component over 9, solder
( ) Insert .003 μf capacitor in 49 and 50, component over 50, solder.
( ) Insert .003 μf capacitor in 42 and 43, component over 42, solder.
( ) MAT121 transistor: insert BASE in 37, EMITTER in 36, COLLECTOR in 35, leaving $\frac{1}{16}$ in. projecting from the copper side, solder.
( ) Bare ends of the RED and two BLACK wires tin. Insert RED in 77, solder, BLACKS in 69 and 70, solder.

Test the RF Section

Connect the RED wire to +3.6 v., one BLACK wire to one side of a pair of low resistance earphones and the other side to −3.6 v. A hissing sound in the phones indicate that all is well, and it is essential to hear it before continuing. If there is no hiss, check all connections, components and current, which should be about 1 mA. Switch on 27 Mc/s carrier, rotate the tuning slug until the hiss stops,

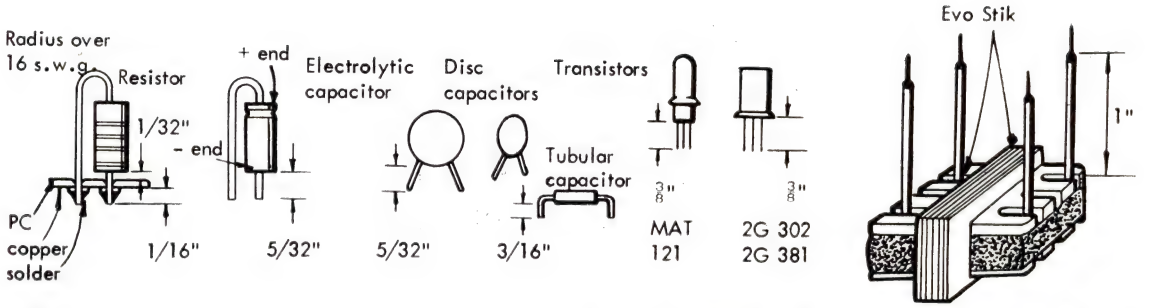
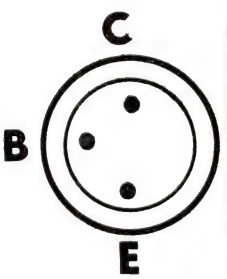


Fig. 4

modulate and the tone will be heard in the phones. Disconnect battery and phones.

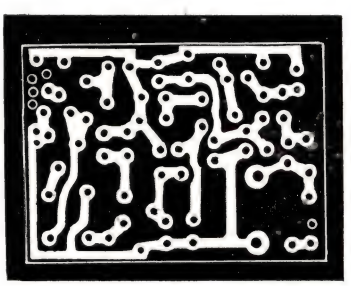
( ) Insert .05 μf capacitor in 40 and 41, solder.
( ) Insert 6.4 μf capacitor in 51 and 52, negative end over 51, positive lead in 52, solder.
( ) Insert 10K resistor in 10 and 11, component over 11, solder.
( ) Insert 27K resistor in 12 and 13, component over 12, solder.
( ) Insert 4.7K resistor in 14 and 15, component over 15, solder.
( ) Insert 10 μf capacitor in 53 and 54, negative end over 53, positive lead in 54, solder.
( ) Insert 3.3K resistor in 16 and 17, component over 17, solder.
( ) Insert 1K resistor in 24 and 25, component over 24, solder.
( ) Insert 10 μf capacitor in 55 and 56, negative end over 56, positive lead in 55, solder.
( ) Cut the leads of transformer to leave 1 in. long, CAREFULLY bare ends and tin. Put a dab of Evo-Stik where each lead leaves the transformer and on the lower laminations. Insert BLUE in 64, YELLOW in 62, GREEN in 63, RED in 65, solder. Press the transformer on to the board.
( ) Insert 150 ohm resistor in 20 and 21, component over 21, solder.
( ) Insert 150 ohm resistor in 22 and 23, component over 22, solder.
( ) Insert 25 μf capacitor in 71 and 72, negative end over 71, positive lead in 72, solder.
( ) Insert .02 μf capacitor in 60 and 61 solder.
( ) Insert 2G302 transistor: BASE in 44, EMITTER in 46, COLLECTOR in 45, solder.
( ) Insert 2G302 transistor: BASE in 57, EMITTER in 59, COLLECTOR in 58, solder.
( ) Insert 2G302 transistor: BASE in 66, EMITTER in 67, COLLECTOR in 68, solder.

Fig. 5



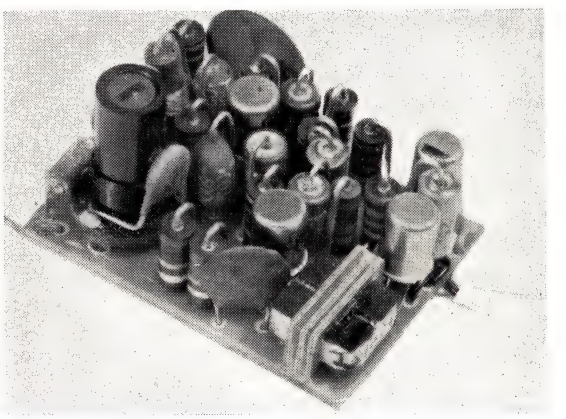
FULL SIZE P.C.

Fig. 6



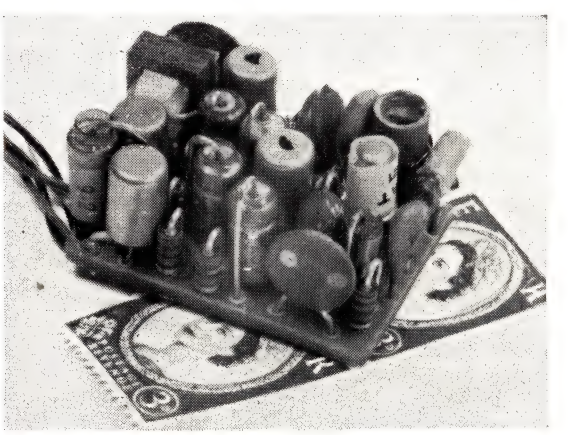
Below: A slightly over full-size photograph of the kit size "Cotswold", note the positioning of C5 on the coil former, left. Heading photograph on page 301 shows all the kit parts and a completed receiver.

Bottom: An enlarged shot of the reduced size Rx available ready made.



( ) Insert 2G381 transistor: BASE in 73, EMITTER in 75, COLLECTOR in 74, solder.
( ) Bare end of WHITE P.V.C. wire, tin, insert in 76, solder.
( ) Bare end of BLUE P.V.C. wire, tin, insert in 30, solder.
( ) Push free ends of P.V.C. wires through board and pull tight: RED in 29, WHITE in 28,

(*Continued on page* 323)



...The Right Angle

CORRECT RIGGING OF A MULTI MODEL . . . FOR BETTER AND SAFER FLYING USE THIS SYSTEM TO CHECK YOUR MODEL

RIGGING . . . the term dates back to the days when flimsy airframes were pulled into the correct aerodynamic shape by adjustable turnbuckles. Any aircraft has, from design stage to the completion of its test flights, to be "rigged" correctly. Radio controlled models are no exception, the fact that radio can be made an excuse for keeping an out of trim, incorrectly rigged model airborne, has led to much inaccurate rigging and maladjustment. Indeed were it not for the pilots' skill many first attempts at design could easily finish in balsa dust.

Well built models and kit designs can be easier to fly if they are rigged correctly. The modern radio model has quite rigid flying surfaces so that if a warp is incorporated during the building it is difficult to straighten it out. Opposite aileron can be used to counteract some of the effects of the warp, but it is not the complete answer; at different flying speed the effectiveness of the ailerons as a means of combatting a wing warp varies. Moral: Build carefully.

Control Surface Adjustment

It is probable that some small trim adjustments will have to be made to set the neutral and extreme positions of the elevator rudder and ailerons. A series of test flights is the only sure way of arriving at the exact trim positions and these adjustments should not be confused with adjustments to the incidence of wing or tailplane which should be positioned correctly in the first place. To correct say, a tailplane which has negative incidence by applying a little down elevator to achieve a "neutral" effect is bad practice. Drag is increased and the effectiveness of the correction varies with airspeed and slipstream. It is better to make a major modification to the airframe by removing and re-fixing the tailplane in its correct position, than to try moving the C.G., changing the thrust line or adding trim tabs, all such procedures can have an adverse effect on the model's performance and efficiency.

Returning to the subject of setting the correct control surface neutral and deflection, the adjustments involved are as follows:

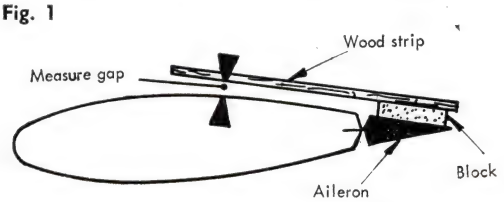
1—Moving the pushrod one hole further in on the control horn to increase the deflection.

2—Moving the horn further from the hinge to give more up and down (assuming the horn is below the elevator) or moving it nearer to the hinge and raking it forward with packing to give the opposite effect.

3—Neutral is set by adjusting the clevis.

Whilst most servos incorporate adjustment for neutral, this is usually coarser than the clevis adjustment, the servo adjustment should therefore be used for the initial setting up of the linkages, trim bar, etc., and the clevis for external adjustment between test flights.

Fig. 1

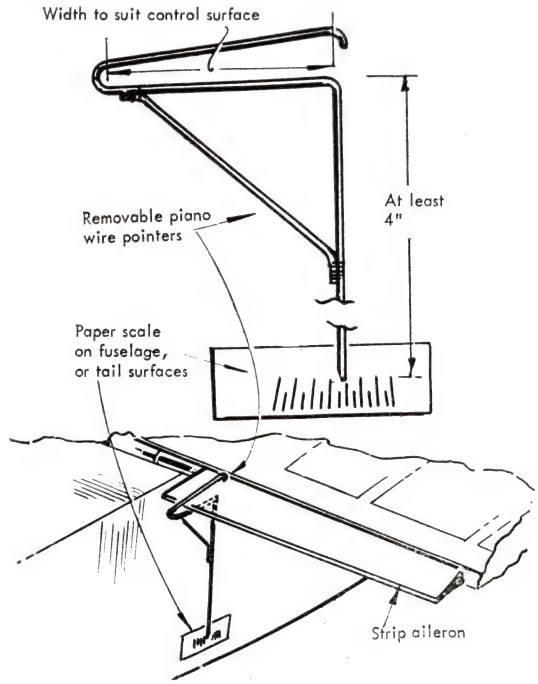


Checking the Angles

The initial setting of the neutral position can be made easier by clipping a balsa extension on to each control surface. (Fig. 1.) Later, a piece of piano wire shaped as shown in Fig. 2 may be made for each model and providing the same set of "indicators" are kept, then comparisons of the rigging and trim angles can be made when building a new model the same basic design or re-rigging after extensive repairs.

For the sake of simplicity reference marks may be made on the fuselage sides to record the control surface deflection of the ailerons and elevator and on the tailplane to check the rudder deflection. Thus, should it be necessary to re-set the neutral of any

Fig. 2


Width to suit control surface
At least 4"
Removable piano wire pointers
Paper scale on fuselage, or tail surfaces
Strip aileron

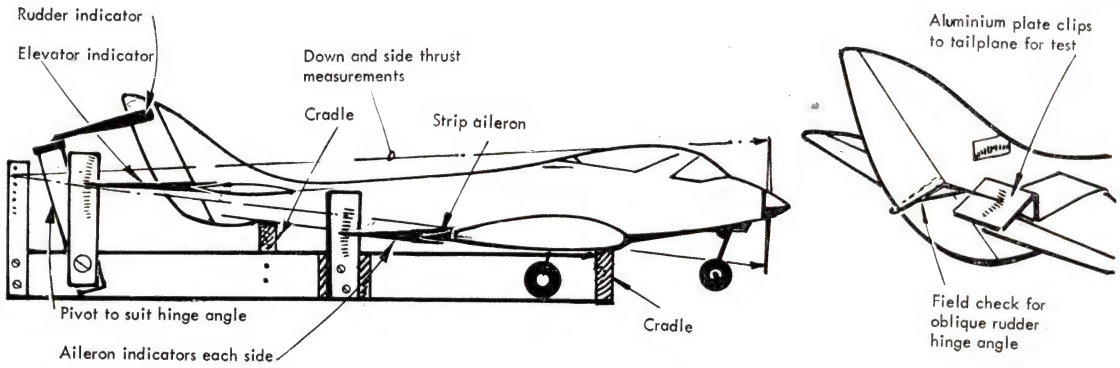


Fig. 3

control surface or check that it is still correct, it is only necessary to slip the piano wire clip on to the appropriate surface and read off the neutral and deflection angle from the marks on the fuselage.

It is not advisable to have permanent pointers attached to the control surfaces, they could be bent accidentally and give the appearance of the need to re-trim.

Rigging Cradle

To aid accurate rigging, once a design has been proved, and in order to produce even a kit model with improved accuracy, a simple jig may be made to locate the flying surfaces and check the motor thrust lines during final assembly. The basic idea is shown in Fig. 3 and is definitely worth making up from scraps of hardboard and strip soft wood. You never know when you may want to make another model with the same aerodynamic set-up and a jig like this ensures that there are fewer variables in the next model. Marks may be made on the jig to line up with the pointers previously described, so that the true neutral of the control surfaces can be more easily set.

With bi-convex flying surfaces and tapering control surfaces, it is a tricky job to align the surfaces accurately, unless a jig or similar device is used. With a flat plate tail, a ruler laid across the surface is the obvious means of checking. The flat plate, however, is not considered efficient by many designers, a bi-convex tail can be made stronger for the same weight and if there is an easy way of rigging the model such as a jig, then it would seem pointless to retain the old flat plate simply because it is easy to position accurately.

Linkage accuracy

Correct use of a jig ensures that the design carries right through to the finished model and does not lose itself somewhere between the plan and the balsa. Checking devices, make sure that once the trim has been found, it can be re-set whenever necessary with a high degree of accuracy. What happens to all these precautions when the pushrod and bell-crank parts of the system fall short of the accuracy we need for consistent performance?

When the pointers are clipped on to the control surfaces, they will indicate if inconsistency exists. Whilst it is inevitable that a small amount of float occurs in the servo neutral, the elevator trim linkage, and the control surface horn, sagging and buckling of the pushrods themselves cannot be tolerated. On the ground, it is difficult to detect any loss of control surface movement or drift of the neutral position which may be induced by a mechanically inefficient pushrod linkage. The obvious way to design a good linkage is to make sure that the pushrod is virtually a straight line between the servo or trim bar and the control surface horn. This cannot always be done; either because the elevator horn is outside the fuselage, necessitating either a large hole for it to pass through, which would weaken the structure, or a kink in the pushrod to take it out through the side with the minimum clearance. The rudder pushrod must cross to the opposite side if a steerable nosewheel is used. This results in a more oblique angle for the pushrod and packing has to be added to the trailing edge of the rudder horn to accommodate the angular change. The pushrod in a model with a non-steerable nosewheel would run more or less straight down the fuselage. This is particularly important when using servo-packs with the rudder servo facing forwards, requiring a stiffened and doubled back linkage. There is only a light load on the rudder but it is particularly important to ensure that pushrod does not distort during loops and bunts, this accounts for inconsistency in some models when executing these manoeuvres. The pushrod bends under "G" conditions and moves the rudder off neutral. You can check this by seeing how little pressure is necessary on the pushrod to produce movement of the rudder whilst the servo is neutral. The answer in most cases is to fit a free running guide to prevent the pushrod system twisting or buckling. The guide should support the piano wire parts of the pushrod, as it is usually this part that distorts. A scrap of old nylon propeller blade makes a good bearing when drilled and bolted to a convenient former or secured with a self tap screw through the fuselage side. Choose a position for the guide where the pushrod will run straight through and not describe an arc. There is practically no friction in such a set-up.

Always plan for the worst conditions; be a pessimist! . . . Suspect every detail. . . . If there is a chance anything going wrong you can be sure that it will go wrong in flight! If you know the rigging is right, then mark the exact neutral position of the control surfaces for future checking by the means described in this article. You should then be well on the way to consistant model performance.

Two Wire Servos

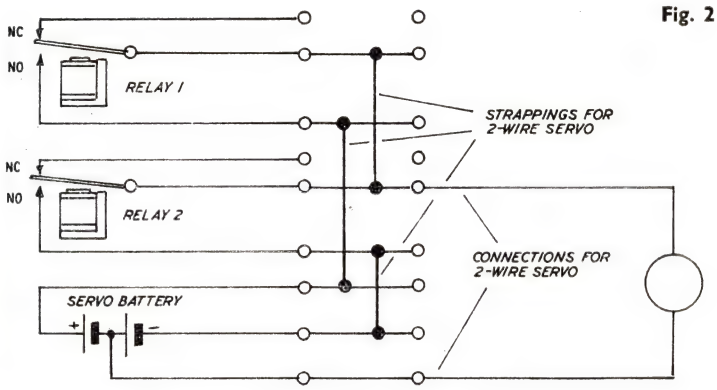


Fig. 2

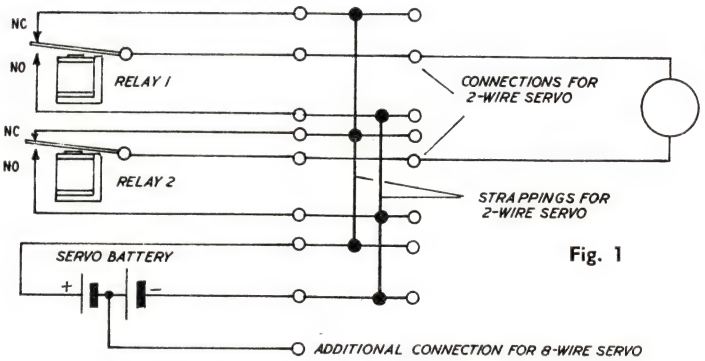


Fig. 1

R. H. WARRING OFFERS ADVICE ON WIRING SPRING CENTRED SERVOS

THE convenience of a two-wire servo hook-up is sometimes overweighed by certain limitations imposed by such a system, particularly when utilising a single battery for the supply. Self-centring must be accomplished by spring-return action which may or may not involve a certain momentary 'hunting' around the neutral position or, more usually, limitations as regards return speed since the motor is effectively shorted across its terminals when being driven back to neutral by an external force. The former is normally insignificant since the reduction gearing necessary between motor and output drive usually provides adequate damping against hunting.

The penalty of slow return, however, may have to be compensated by other means, such as providing additional resistance in the motor circuit to minimise self-regenerated braking currents. This, in turn, means a higher battery voltage to maintain the same current through the motor for normal operation. The order of external resistance required to produce a favourable return speed is usually the same as that of the motor coil resistance, which means that battery voltage will need to be doubled to maintain the same current through the motor for normal driving. Thus only half the battery energy is employed usefully, the other half dissipated in the resistor being completely wasted.

Further problems may also arise when different servos are 'mixed' in the same system—e.g., a conventional eightwire servo is used for one service and a two-wire servo for another. Although applied to different pairs of relays, the connections are quite different, and also the servo battery demands. This may be further complicated with plug-together units like the Grundig receiver where provision is made for a single battery output via the (filter) stage sockets and a centre tapped supply must be wired separately to an eight-wire servo.

To achieve operation of a servo motor via two relays and a single battery, cross connection is necessary as in Fig. 1. In the case of plug-together units such cross connection is normally made by strapping inside the servo plug thus leaving the relay output connections 'open' on the receiver stage itself for normal connection to any other type of servo, if required. In the Grundig system the positive and minus battery is also led through the receiver circuit to the receiver output stage sockets, so that should a centre-tapped connection be necessary this is made as an additional external wire.

If servos are to be mixed, wiring remains relatively straightforward except that using a centre tapped battery to operate conventional eight-wire servos the *full* battery voltage is applied to any two-wire servo also incorporated in the system. This may represent twice the normal demand for that servo. However, if a resistor is included in the two-wire servo circuit this will serve the dual purpose of speeding up the spring return and also drop the battery voltage to its proper level.

The 'braking' action of such a circuit on a spring-return servo motor can be followed by studying the relay switching action. Operation of one relay completes the battery circuit to the servo motor with one direction of polarity; operation of the second relay completes the servo motor circuit with opposite battery polarity. If both relays should operate simultaneously for any reason the battery circuit remains

open, so the circuit is quite safe to use with reed receivers.

On release of signal the appropriate relay drops out, disconnecting the battery supply. As far as the servo motor is concerned, however, it is now shorted across its own terminals via the two relay armatures each contacting their NC contacts which are commoned. Any drive applied to the motor (e.g., the spring return) causes it to act as a generator, and the fact that the output is shorted produces a strong self-braking effect.

Now consider the alternative circuit shown in Fig. 2. This uses a centre tapped battery as standard, so is equally suitable for eight-wire or two-wire servos. In the case of eight-wire servos connections are made in the conventional manner, with only the relay armatures commoned for a single wire connection. The remaining seven connections are then made to the NC and NO relay contacts and the three battery points (positive, negative and centre tap).

With a two wire servo the NC contacts of both relays are ignored entirely. The relay armatures are commoned and one lead to the servo motor taken from this point. The other servo motor lead is taken to the centre tap of the battery.

Operation of one relay now has the effect of completing a circuit with one half of the centre tapped battery through the servo motor. Operation of the other relay has the effect of completing a circuit with the other half of the battery through the servo motor, this time with reversed polarity.

This has two distinct advantages. In the first place it 'splits' the battery voltage down to a normal operating level for a two-wire servo (i.e., half the voltage of a centre tapped battery). Also, on release of signal, the servo motor is on *open* circuit as far as external connections are concerned, so there is no self-generated braking effect to slow the return action. The only disadvantage is that should both relays pull in simultaneously for any reason the battery is short circuited via the relay contacts which could cause severe damage to the contacts, or even weld them together. Such a wiring system would, therefore, appear safer to use with a tone filter receiver where the channel separation is much wider and there is little risk of simultaneous operation than with a reed-relay receiver.

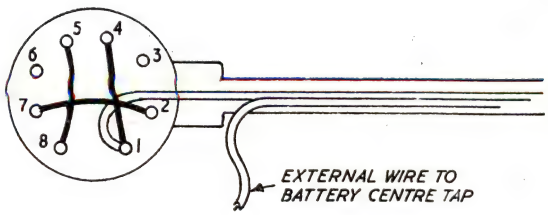


Fig. 3

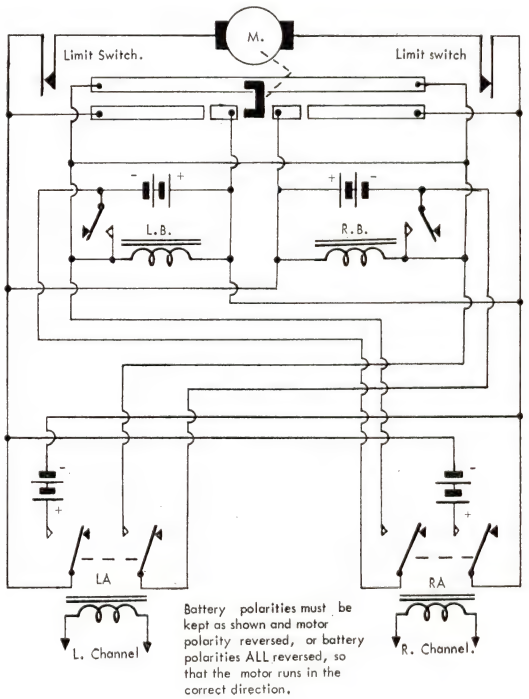
With a plug-together system such as the Grundig where a two-wire servo is connected to a plug strapped internally for the first circuit operation (Fig. 1), some modification is required since the necessary internal strappings are quite different and only one lead from the servo motor goes to the receiver stage (filter) socket. The other motor lead goes directly to the centre tap of the battery as an external wire, although the positive and negative ends of the battery can be fed into the receiver via the usual harness. Plus connections for the two-wire servo (e.g., Bellamatic) are then as shown in Fig. 3.

Steering Circuit for Boats

this circuit by K. J. MACKIE gives neutral on 2 channels with a progressive servo

HERE is a circuit for a switching device used to steer a model boat. It requires two channels, each with a DPDT or DPST relay (A's) and two other relays (B's) which will work on the same voltage as the motor in the steering mechanism. It is suggested that the circuit be set out as in Fig. 1. The servo requires a slider on the steering mechanism with four contact points as shown in the circuit diagram.

This is how it works. If the control is at neutral and right-rudder, shown on the right-hand side of the circuit, is keyed, the servo moves in that direction. But to return the control to neutral, a quick flick is given on the left rudder channel, and the unit centres itself. This uses the RB relay, which holds itself on after keying left, and is momentarily shorted out just off neutral, returning the relay armature to N.O. and turning off the motor. Simple, isn't it?



GADGETS & GIMMICKRY

WHAT a bundle this month! Luckily all are so simple that only a short description is necessary, some do not even need explanatory sketches. Keep up the good work, all ye Gadgetiers, quick and crafty ones go down well. . .

Low Friction Yoke (Sketch **A**)

The first idea comes from the Belgium news-sheet "Fede" and shows how to simplify the yoke and crank linkage normally used to operate single channel aircraft rudder. Usually the rudder has a piano wire loop driven by a rocking crank which has to be a free fit in the yoke. Thus there is a fair amount of float around the neutral position and the chance of a friction at extreme positions. A scrap of old nylon propeller drilled at right angles so that the holes just miss each other makes a neat low friction coupling to transmit the drive to the rudder. As the two wires which are single, change in angular relation, the nylon block slides and turns without any loose or tight spots.

Trimming Wires (Sketch **B**)

R. H. Parry tells us that he uses small nail clippers of the type illustrated for trimming component leads on p.c. board assemblies. They are obtainable quite cheaply from large stores and apparently cut wire up to 18 s.w.g. thickness. They make a neat job and can be brought closer to the solder than side cutters. The result is quick and it is unnecessary to finish the job with a file.

Save Those Drills (Sketch **C**)

Now for a batch of three ideas from J. Whitehead. The first saves time, temper and fine twist drills. We have noticed many people do not bother to clamp tiny p.c. boards down for drilling, the result of a board slipping just as the drill comes through usually results in the drill breaking. All you have to do, says our gadgetier, is to have a larger heavier piece of wood with a number of panel pins driven into it. Place the p.c. against any two and hold it down with two or three extra panel pins.

Heat Sinks (Sketch **D**)

A handy and compact heat sink can be made by winding a close space coil of 18 s.w.g. (or thicker) tinned copper wire on the transistor can. It should be a really tight fit. Wind it on, take it off, give it an extra twist, force it on again and secure it with a dab of paint.

Transistor Support (Sketch **E**)

Transistors treated in the manner just described can also derive extra support to resist hefty prangs. Make the heat sink coil as before but leave $\frac{3}{16}$ in. wire projecting at the top. This can now be soldered to a piece of piano wire before fitting to the transistor, the other end of the piano wire is soldered into a spare p.c. land. Remember some transistors have "live" cases so the supporting land should be either common to this connection or isolated.

Tidy Bits (Sketch **F**)

The plastic honeycomb defuser strip from an old strip lamp fitting (obtainable spare from electrical shops) makes a good storage system for small components. M. Parrott who suggested this gadget glues pieces about a foot long on to a piece of Formica using Evo-Stik. This makes a bottom to the boxes and a communal lid made from Perspex could be used to keep out dust.

Mounting Pads (Sketch **G**)

Another Parrott idea, he must be limping now! Concerns the use of shoe inner soles which for a cost of 1/6d. pair yield plenty of $\frac{3}{16}$ in. thick soft foam rubber, ideal for mounting servos and other pieces of R/C gear by the rubber bonding method.

Cable Clips (Sketch **H**)

For a professional finish to an installation, J. Bullock uses the little chrome clips normally sold for Morphy Richards electrical items at about 2d. each. The type illustrated is normally used on electric irons.

Pilots' Gloves (not illustrated)

No sooner do we get an idea for making the shivering pilots' life more bearable, then along comes the warmer weather . . . never mind save this one up, you will need it later. R. Ringsell cuts the thumbs from a pair of old but warm gloves. Wearing these whilst holding the transmitter does not impair control as the thumbs are quite free to manipulate controls and because the rest of the hand is warm and the thumbs are on the move one can fly in comparative comfort. What to do with the thumbs? The next idea explains.

Glow Clip Safety (Sketch **J**)

D. Redrup suggests the use of the thumb from an old glove as a precaution against run down starting batteries.

Bind the thumb point downwards to the battery or its case, where it serves as a parking receptacle for the plug clip. If you remember to pop the clip back into the pouch so formed instead of dropping it in the nearest puddle, or worse on some metal object, there is less chance of the battery being shorted between starts.

DEAC Charging (not illustrated)

If you have a suitable meter to hand to check the charging rate it is possible to make an economy in the purchase of a charger for DEACs.

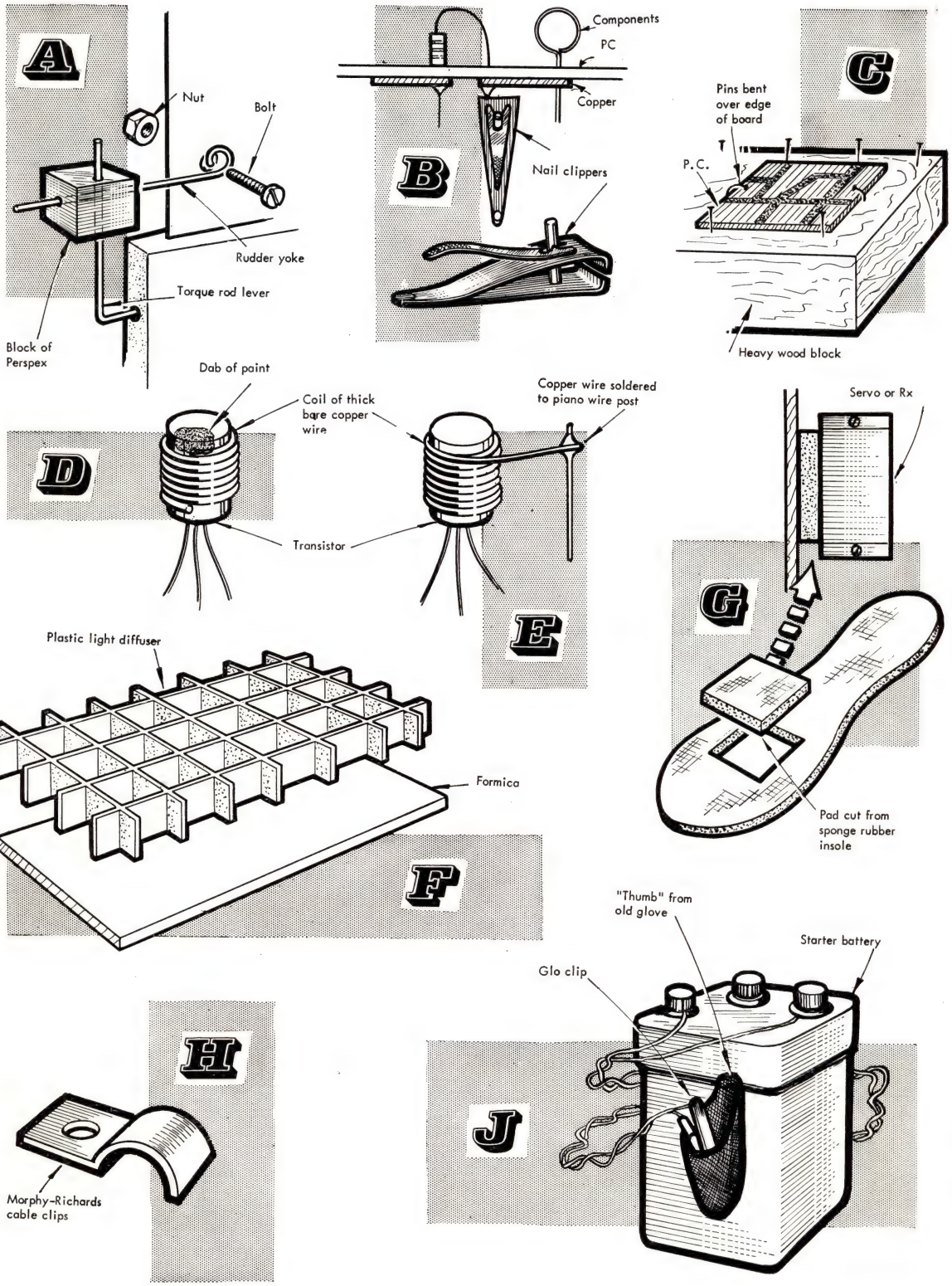
T. Levi found that the Playcraft model railway power unit (Woolworths) comprises a transformer rectifier unit with a variable output. The example he tried could be adjusted to 15 to 100 mA, and by using a meter he was able to calibrate the speed control knob to give various rates of charge.

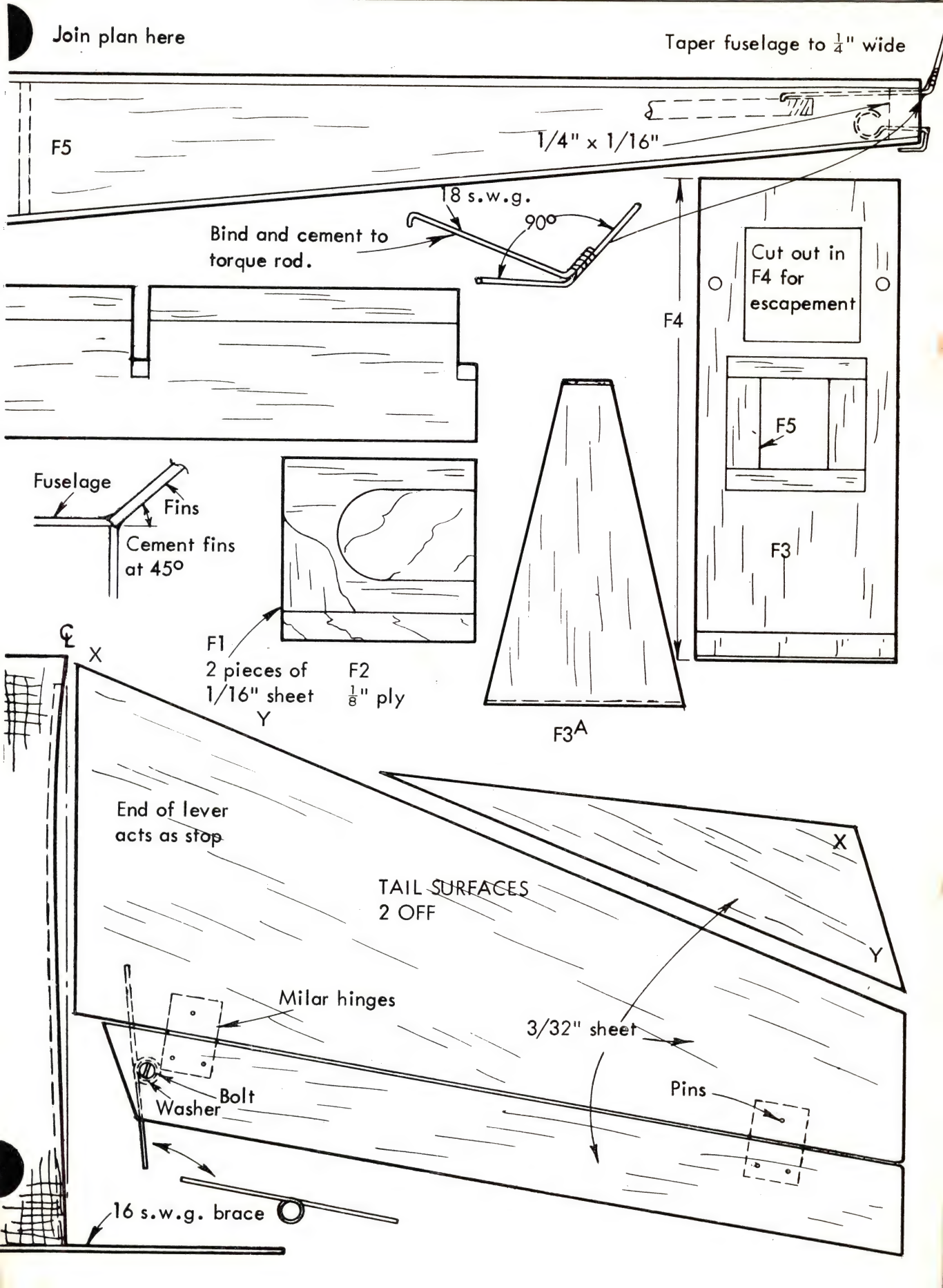
Extra Tones (Not illustrated)

J. H. Skeat wanted to add four channels to a Reptone 6 Tx to operate an R.C.S. 10 Rx.

The method was to alter the transmitter tones in a reverse direction to that normally effected by capacitors. The natural tone frequency of the transmitter, i.e., with no capacitors in parallel with the keying switch, was just a little too low to drive the shortest reed in the receiver. Rather than change the main tuning capacitor which would in turn mean retuning the other 9 reeds, he simply connected the secondary side of a small transformer to act as a choke across the keying switch. This raised the natural tone above that required to operate the reed, which would then respond by tuning with capacitors in the normal way.

This is very useful when matching Txs and Rxs of different makes and also when adding channels.


A
Nut
Bolt
Rudder yoke
Torque rod lever
Block of Perspex
B
Components
PC
Copper
Nail clippers
C
Pins bent over edge of board
P.C.
Heavy wood block
D
Dab of paint
Coil of thick bare copper wire
Transistor
E
Copper wire soldered to piano wire post
F
Plastic light diffuser
Formica
G
Servo or Rx
Pad cut from sponge rubber insole
H
Morphy-Richards cable clips
J
"Thumb" from old glove
Starter battery
Glo clip


Join plan here
Taper fuselage to $\frac{1}{4}$" wide
F5
1/4" x 1/16"
18 s.w.g.
90°
Bind and cement to torque rod.
F4
Cut out in F4 for escapement
F5
F3
Fuselage
Fins
Cement fins at 45°
F1
2 pieces of 1/16" sheet
F2
$\frac{1}{8}$" ply
F3A
X
Y
End of lever acts as stop
TAIL SURFACES
2 OFF
Milar hinges
3/32" sheet
Bolt
Washer
Pins
16 s.w.g. brace

PETER HOLLAND'S SIZE 9

A NOVEL 'V' TAIL FLYING BOAT FOR ESCAPEMENTS OR SINGLE CHANNEL PULSE SYSTEMS

A FLYING boat with a normal hull, when scaled down to a convenient size for small motors and lightweight radio gear, suffers in terms of efficiency when it comes to lifting off cleanly and landing without taking a severe ducking. Some hulls have sponsons to prevent them healing, small sponsons are comparatively inefficient, and when added to a slim hull result in a plan form which may not be best for take-off.

A simple single sponson which forms the hull really takes this model out of the "seaplane" category. Single float seaplanes usually have additional tip stabilisers, so they really classify as a three float craft. We want the minimum number of components in a simple model, so "Size 9" just has one large "boot" on which to ride the waves.

Like all the best boots, this part is removable and retained with rubber bands (elastic sided?). The reason in this case is to take landing shocks if the model comes in heavily. There is a likelihood that the windscreen then takes some of the shock, but with strong bands, the effect is vaguely similar to a sprung undercarriage and certainly saves some damage to the hull when flown over grass. There is a false bottom to the fuselage so that the radio gear keeps dry. The whole radio bay, being in the cabin is reinforced fore and aft by tapering fairings built round corners 3 and 4. A hole is shown cut in the latter to accept Elmic Conquest escapement which is connected via usual balsa torque rod to a special 90 deg. crank designed for kick either rudder of a "V" tail up, in turn.

The same linkage may be used for a pulse proportional actuator of the Septalette type or a geared electric motor used in simple rudder only systems. The "V" tail configuration can, by use of "kick up only" control surfaces obtain a touch of up "elevator and rudder" together. This, when control is applied carefully, can assist in keeping the model fairly level in a turn. If the model is trimmed for penetration, blipping left and right quickly will produce climb; for both control surfaces operate in the "up" part of their arc and contribute to the elevator effect. They simply blow back against stops for the neutral position. A thin piece of shirring elastic will assist the control surfaces back to neutral, this bias is hardly necessary and must of course be very weak so that little additional load is placed on the actuator. The stops are an extention of the control surface operation levers bolted to the control surface. Slivers of $\frac{1}{32}$ in. ply packing can be fixed to the under surfaces of the tail to give the correct pitch trim.

Dual Proportional

A simple rudder only type proportional actuator may be used, but an improvement in neutral condition may be obtained by arranging the "V" shaped crank on the torque rod so that a few degrees of movement are allowed before one or other of its arms strikes the appropriate control surface operating lever. In this condition both surfaces are against their stops and neutral drift of the actuator produces no unwanted effect.

Heading photo shows a version without the windscreen, this is more "prang" resistant when the hull knocks off. Right: Did you say a flying boat or a flying "boot"! "Size 9" flaps neatly on to the water instead of digging in.

If the pulse rate is changed, a low rate in the neutral position produces an equal deflection of the control surfaces (both up), a high rate in the neutral position allows both control surfaces to rest on their stops. It is thus possible to fly almost like Galloping Ghost with a magnetic actuator. A larger model would need a geared motor with the same purpose, but the linkage is, if anything, more simple to construct and with down trim, the hitherto sensitive "rudder" effect is not felt.

Manual pulse could also be flown this way for a really "groovy" neutral. Doug Bolton uses an arm and striker type of linkage for manual pulse on ailerons, this method was described in the December, 1964, Gadget page. Our "size 9" application gives pitch control, the designer cannot recall any previous "V" tail configuration which has used this groovy neutral linkage, plain escapements have been used successfully on "V" tail slope soarers and special linkages have been devised for multi models with "V" tails. The effect tried on proportional seems certainly worth carrying further.

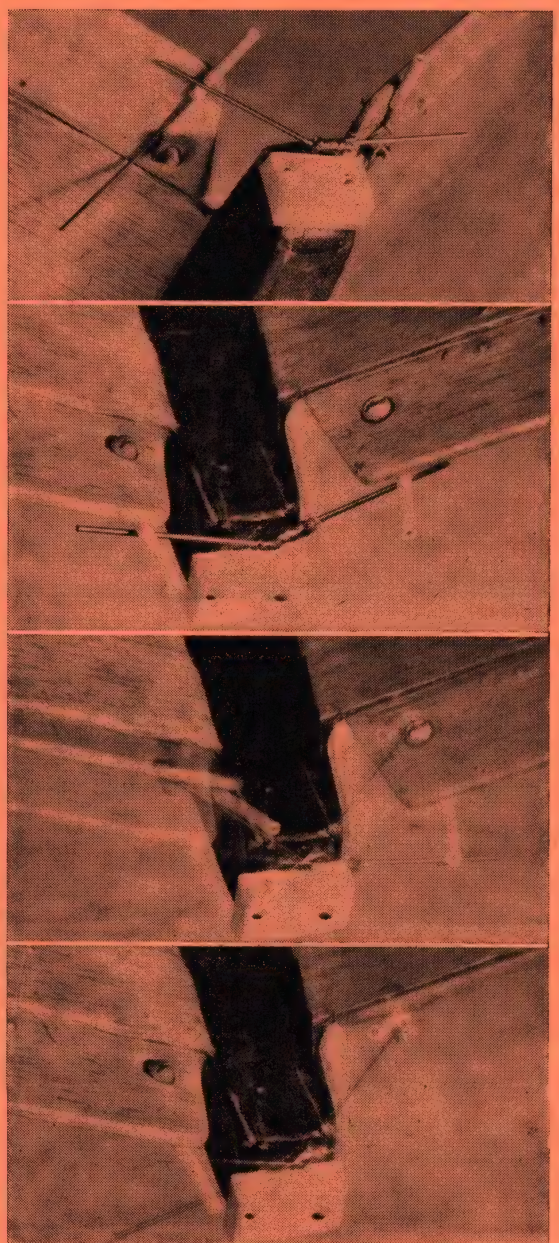
Construction

The wings have a sheet top surface structure with a tissue lower surface covering. The leading edge is sanded from 1½ x ¼ in. and sits at an angle on the wide spaced ribs. A piece of 4 in. x $\frac{3}{32}$ in. forms the remaining part of the structure. Double ribs are used at the tips and centre section, a piece of 16 s.w.g. piano wire bent to the dihedral angle is taped to the centre section trailing edge to prevent the wing bands cutting in. More scrim or bandage is cemented over the centre section top and bottom to reinforce the joint once the wing halves have been set at the correct dihedral angle (1½ in. under one tip). This form of construction is used successfully on the "Twophin" (December, 1963) which is still going strong. The fuselage is a $\frac{1}{16}$ in. sheet box with cross grained $\frac{1}{16}$ in. sheet doublers between formers 3 and 4. The two top corners are chamfered to take the fins and strakes which are cemented at 45 deg. (90 deg. to each other). The tail end is small in cross section but there is just room for a $\frac{3}{16}$ in. square torque rod and a loop of ⅛ in. flat rubber. A piece of plastic wire sleeving serves as a bush for the wire end of the torque rod, the winding hook is bent over the open end as a means of attachment.

Choice of engine capacity must be governed by the preference of the builder for flying from water, or merely using this design over land as a change from a more orthodox configuration. A .5 c.c. motor is adequate in this case, but up to 1 c.c. could be used for fast water-borne operation. Do not exceed 1 c.c., the wing area is small. If you have a choice of motors, so much the better; start with something small, hand launch, then when the control technique has been mastered (whichever system you have chosen), a more powerful motor will enable you to enjoy a much hotter performance. A .5 c.c. motor must be tuned to provide maximum "urge" to lift the radio payload and overcome water drag on take-off. Wiggling the "rudders" should help the model during the initial taxiing period, once it is planing nicely it should unstick on its own. The high thrust line tends to put the nose down, so careful positioning of the C.G., C.B. (centre of buoyancy) and thrust line was necessary in the design stage.

If the under surface of the hull is covered in $\frac{1}{32}$ in. ply the model will last longer, thin celluloid or Polyglaze could be used instead to give a nice shiny planing surface. Heavyweight tissue covering is adequate for "size 9" but a good standard of doping and fuel proofing is necessary to prevent the balsa becoming waterlogged. It is most important to pop the receiver and the batteries into a thick Polythene bag, the neck of which should be bound securely where the harness emerges. A 3 pin "slice" from an AEI connector serves as a switch.

Top: Strikers and levers, note lever extension for stop and block stop on fuselage. Lower three, top to bottom: Unretouched action shots of proportional Down, Up, and Right.



Tx. Aerial Efficiency

By F. G. RAYER Assoc. Britt. I.R.E:

THE actual strength of the radio signal radiated from the transmitter aerial depends very largely on the efficiency of the aerial itself. The power which may be used in a model control transmitter is very limited, and so is the sensitivity of the simpler type of receiver. For working at maximum range, or securing a good range of control with a very small transmitter, or a simple receiver, it is thus necessary that the transmitter aerial can perform well. The loss of radiated power, due to an ineffective aerial, can be very great indeed. An improved aerial can then give greater range, more reliable working, and possibly more economical transmitter consumption, as well as making receiver adjustments less critical.

An aerial which is approximately vertical is often used, and this is very satisfactory, because vertical aerials can give good low-angle radiation. The field of radiation is well maintained up to an angle of some 60 to 70 deg. or so above the horizon, and then falls in strength, being least in line with the aerial (directly overhead). The field strength is about the same all round the aerial, towards all points of the compass. This lack of directivity is well suited to model control purposes.

If an aerial is a ½-wave long at operating frequency, there is a large excursion of voltage, this being at maximum at each end, and near minimum at the centre, as in Fig. 1. The distribution of current is also shown in Fig. 1, and current is large at the centre of the aerial, but virtually zero at the ends. If the aerial is of the correct length, so that it is resonant on the operating frequency, these excursions of current and voltage can be very great, and radiation is high.

Radiation is maximum from those parts of the aerial where the current is large. Unfortunately, a ½-wave vertical aerial is rather long for 27 Mc/s, and is seldom used. To keep dimensions down, a ¼-wave is often employed, and current distribution is as in Fig. 1. Radiation is less than from the ½-wave. Aerials shorter than ¼-wave are also used, and radiation is even more reduced.

When the aerial is shorter than a ½-wave, the length is made up by the earth, or a coil in the transmitter. Coupling between transmitter and earth may be only by capacity effects. This can introduce further losses.

An aerial has a particular impedance (shown by Z in Fig. 3). With a ½-wave aerial, the end impedance is very high, because there is high voltage but low current. For a round figure of reasonable accuracy, this may be taken as 1,000 ohms. A ¼-wave aerial, however, is fed at a point of high current and low voltage, and this is low impedance. Again, the actual figure depends on other factors, but may be conveniently taken as 50 ohms. (Usually it is quite near this.)

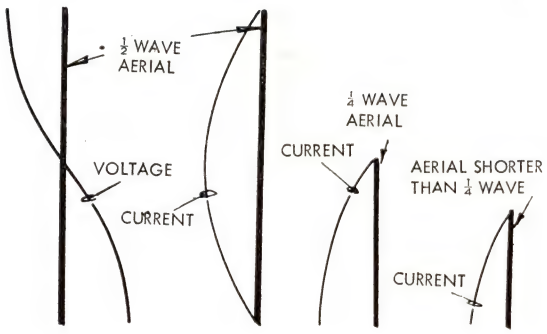


Fig. 1

The feed point impedance has considerable bearing on the method of feeding, and on losses due to earth circuit impedance. As example, assume the earth circuit impedance (or resistance) were 15 ohms, and that radio frequency power dissipated in this is lost. The proportion of energy lost with the 1,000 ohm feed point is insignificant (15:1,000) but with the low impedance feed point it is quite a heavy loss (15:50).

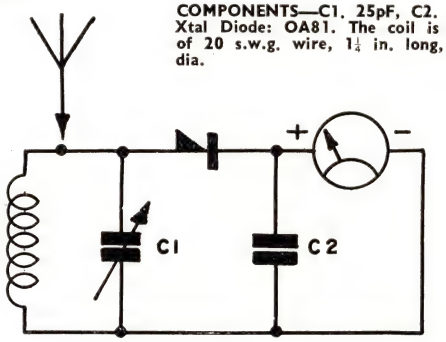
Field Strength Meter

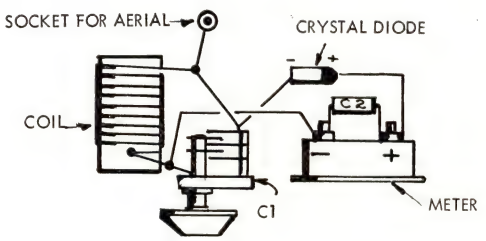
When beginning transmitter aerial tests or experiments, a field strength meter is desirable. This can be made as in Fig. 2. The coil can have about 12 turns of 20 s.w.g. or other wire, occupying about 1½ in. on a ⅞ in. dia. former, and it is tuned by the 25 pF or similar variable condenser C1. (Any other coil tunable to the 27 Mc/s band will suffice.) C2 can be 100 pF to 0.01 uF or thereabouts. The meter is preferably 100 uA or 250 uA full-scale.

For use at some distance from the transmitter, a short aerial will be needed on the field strength meter. This can consist of a few interlocking aerial rods, or

Fig. 2

COMPONENTS—C1. 25pF, C2. 1000 pF. Xtal Diode: OA81. The coil is 12 turns of 20 s.w.g. wire, 1¼ in. long, ⅞ in. in dia.





a telescopic aerial, or it may even be a stout, straight vertical wire. If the same aerial is always used, and the field strength meter is always placed on the ground at the same distance from the transmitter, quite accurate comparative results can be obtained. The distance adopted will depend on meter sensitivity, and aerials, but may be some 10 to 20 yds, or so, or closer for low-power transmitters.

The field strength meter is always tuned to resonance, by means of C1, this corresponding to maximum reading on the meter. Work at the transmitter aerial is then directed towards increasing the meter reading, which indicates an increase in the radio frequency field strength.

Transmitter Input

The D.C. input to the transmitter can be found by multiplying the H.T. voltage by the current drawn by the valve or valves energising the aerial. That is, by including a meter at the point X in Fig. 5.

The H.T. voltage is known, or can be measured. Current is expressed as a fraction of an ampere, and 1,000 mA equal 1 amp. As example, assume a 120 v. supply is used, and the valve (or valves) draws 20 mA. 120 x 0.02 = 2.4. So the D.C. input to the transmitter is 2.4 watts.

It may be necessary to know the D.C. input, or at least the H.T. current. If one aerial is to be compared with another, the transmitter should be working with the same D.C. input in each case. In addition, it is possible to load a transmitter into an aerial in such a way that the aerial draws power, which may cause the valve anode current to rise greatly, and the maximum ratings of small battery type valves might easily be exceeded. A check on H.T. currents will avoid this.

Radiated Power

The power radiated by the aerial can be found by squaring the aerial current, and multiplying by the feed point impedance. That is, $I^2 \times Z$, as in Fig 3. As the feed point impedance will usually not be known (methods of determining it being somewhat complex) this radio frequency meter will generally be for comparative purposes. Example, if the current increases, while the aerial impedance is unchanged, radiated power has increased.

If a field strength meter is being used, the R.F. meter in Fig. 3 may be omitted, because maximum R.F. current into the aerial will agree with maximum indication on the field strength meter. But if much experimenting is done with aerials, the R.F. meter can be very useful.

Such meters are available as surplus, and are thermo-couple instruments, and are used for R.F. only. Usually, a 0-300 mA or 0-350 mA meter will suffice.

A small increase in aerial current represents quite a large increase in radiated power. This is because power = $I^2 \times Z$, not $I \times Z$. As example, assume that the aerial feed point impedance is known to be 50 ohms, and that the R.F. meter initially shows 0.1A (100 mA). 0.1 x 0.1 x 50 = 0.5 watt. Now suppose the aerial current is increased to 0.2A (200 mA). The power is now 0.2 x 0.2 x 50, or 2.0 watts. That is, a fourfold increase, though aerial current has only increased twofold.

The difference between the D.C. input, as described, and the R.F. output, as found by this method, represents lost power, due to the transmitter design.

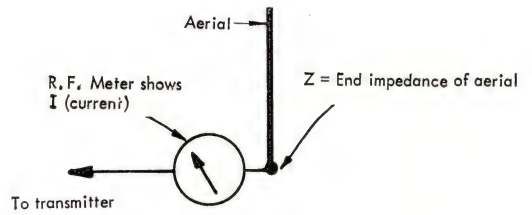


Fig. 3

Some losses always arise, but they may be increased by inefficient coil design and similar factors.

When making experiments with a meter included as in Fig. 3, it is important to remember that changes should not be made to the aerial itself. Such changes will modify the impedance Z, and so alter the meter reading. So this method is only used when experiments are being made with the transmitter coil, coupling circuit, or any circuit between transmitter and meter.

Loaded Aerials

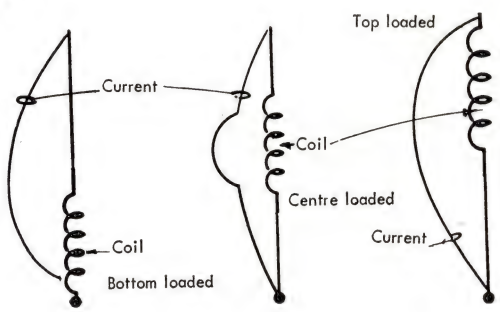
The length of a ½-wave on 27 Mc/s is around 17 ft. and this is too long for a handy, self-supporting whip. A ¼-wave is around 8 ft. 6 in. For the reasons described, earth losses are much smaller with an aerial approaching a ½-wave long, than with an aerial near a ¼-wave long. Referring to Fig. 1, radiation was seen to be most from that part of the aerial where current is greatest. In order to get this current point well above ground, yet keep the aerial length down, a loaded aerial can be used.

Three loaded aerials are shown in Fig. 4. In each case the actual aerial is shorter than a ½-wave, but a coil is added, to make the combined system a ½-wave electrically. If the coil is suitably adjusted, the whole system can be resonated as a ½-wave.

If the coil is at the bottom of the aerial, few turns are needed, but the maximum current is rather low down, as in Fig. 4. If the coil moved up, the maximum current point is raised, but the coil needs more turns. If the coil is at the top, the current is as high as possible above earth, but the coil must have more turns. This may introduce losses, and makes the system top-heavy. So the loading coil is often placed at about the middle of the aerial, though it is practicable at the bottom, or elsewhere.

To keep equipment portable, an insulated tube about 1 in. in diameter can be used for the coil form. An insulated disc is fitted in each end of the

Fig. 4



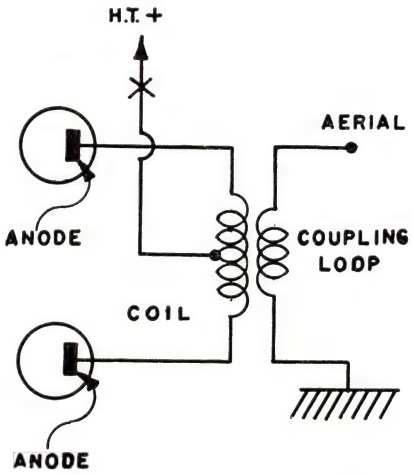


Fig. 5

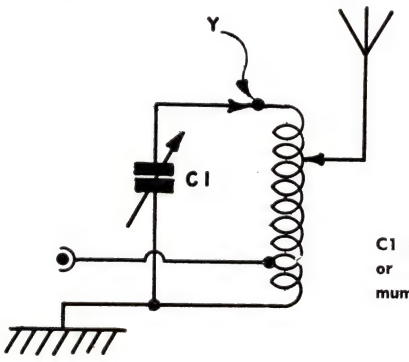


Fig. 6.

C1 may be 50 pF or 100 pF maximum capacity.

tube. Each disc is equipped with a socket to accept the aerial rods, or a length of aerial rod, so that the loaded section can be incorporated.

The coil will only need relatively few turns, but the number depends on the lengths of the aerial above and below the coil, so must be found by trial. Fairly stout enamelled wire is suitable—say 18 s.w.g.

Any length of aerial can be made up to an electrical ½-wave, in this way. But very short aerials will still give reduced power radiation, though a short, loaded aerial will radiate more power than an unloaded aerial. Generally, an aerial shorter than about 4 ft. or so would not be adopted. Increased length still improves results, but less than with an unloaded aerial, because efficiency is initially higher. Experiments with the coil are directed towards best field strength, the D.C. input to the transmitter remaining unchanged. Alternatively, final tuning may be at the bottom end of the system, with an aerial tuner.

Transmitter Coupling

Many transmitters have a power stage similar to that in Fig. 5, with either separate valves, or a double valve. The coupling loop goes straight to the aerial.

If the complete circuit, which includes the aerial, is properly designed, reasonable efficiency can be obtained. But if the equipment is not so designed, much power may be lost, because the coupling loop is unable to work at optimum efficiency over a range of aerial impedances.

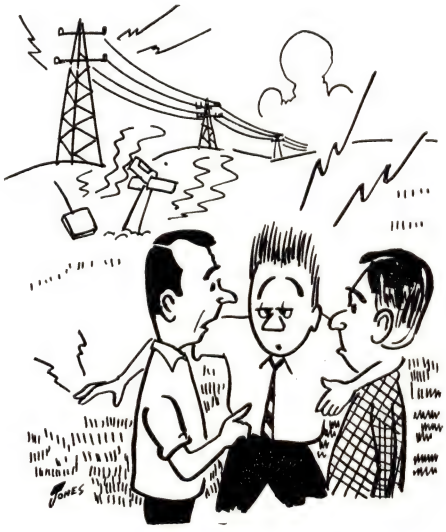
With a given aerial, an increase in radiated power may thus be obtained by critical adjustments of the loop, both as regards the number of turns on it, and its coupling to the tuned tank coil. With many designs, such adjustments are difficult to make. To overcome this, an aerial tuner may be added.

An aerial tuner may be used to tune the whole aerial system to resonance, and also to match the impedence of the transmitter output to the end impendance of the aerial. One simple tuner of this kind is shown in Fig. 6. Air spaced tuning condenser C1 can be about 100 pF. If the coil has spaced turns, on a ribbed former, tapping clips can be attached anywhere along it. It is tunable to 27 Mc/s, so will only need seven or eight turns, well spaced, on a 1¼ in. or similar ribbed former.

The tapping from the transmitter aerial socket should only be a turn or two from the chassis end of the coil, so as to match the coupling loop (Fig. 5). C1 is adjusted to obtain resonance, and the aerial is tapped down the coil to the position which gives maximum field strength, or maximum current on the R.F. meter (Fig. 3), or loads the transmitter to the maximum allowable H.T. current.

Ordinary or loaded aerials may be connected to the tuner. C1 should tune so as to give a sharp increase in field strength. If not, move clip Y to adjust the number of turns. The tuner is particularly intended to feed ½-wave aerials. That is, an aerial which is electrically somewhere near a ½-wave long, or which is at least longer than a ¼-wave.

Remember that changes to the aerial or aerial tuner, or coupling loop, will probably make necessary slight re-tuning of the transmitter. If the transmitter is not crystal controlled, care must be taken that it is kept in the permitted band.



We don't usually have this trouble with pylon racing !

Radio Controlled 36" class Yacht

J. S. HANDYSIDE, R.C. YACHT ENTHUSIAST FROM AUSTRALIA SHOWS HOW HE FITTED MULTI TO A M.M. PLAN CRAFT

AT first I had my doubts as to whether radio equipment could be built into a yacht of this size which would not upset her sailing qualities to any marked degree. On the other hand if the weight of the equipment was kept to the barest minimum by using very small batteries and motors; the power required for rudder and sheet control might be insufficient.

I think that the equipment to be described is a happy compromise, and should give a lead to those who are building a similar boat. It is important that the heavier radio equipment, namely batteries and motors, be mounted as low as possible in the hull and be bunched together over the lead in the keel. In order not to exceed the boat's maximum weight the keel has to be reduced by an amount equal to the weight of the radio equipment. The only other major change is the design and construction of a really large removable hatch which is water-tight.

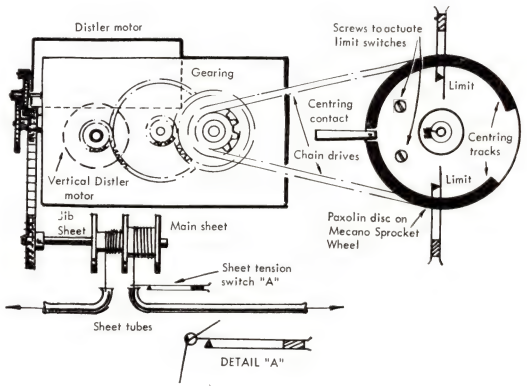
The yacht chosen is the *Lady Betty* (Model Maker Plans Service MM190) fitted with a self-centring rudder which can also be "inched" to any position. The jib and main sheets are controlled together. The sheets are secured to the ends of the booms and run on to a drum which has two diameters to compensate for the different lengths of the booms. The slot between the jib and mainsail is set to size by a bowser on the jib sheet and remains the same as the sheets are payed in and out.

This little craft is quite often sailed in the sea and hence all external metal parts are either nickel plated brass or stainless steel. The sheets are run through small copper tubes from the deck to the drum and therefore very little water collects in the bilge due to this arrangement.

Radio Receiving Equipment

Mr. J. Podlaski's Selectatone Receiver is used with five channels in the output. The functions are: Port and Starboard rudder; rudder hold; sheets in; and sheets out. The bandwidth of each tone is wide enough to cope with an ambient temperature range of 50 to 80 deg. F. However, I did have trouble during initial testing with harmonic operation and ended up with the filters tuned to the following frequencies: 1,440, 1,610, 2,400, and 3,450 c.p.s.

Fig. 1



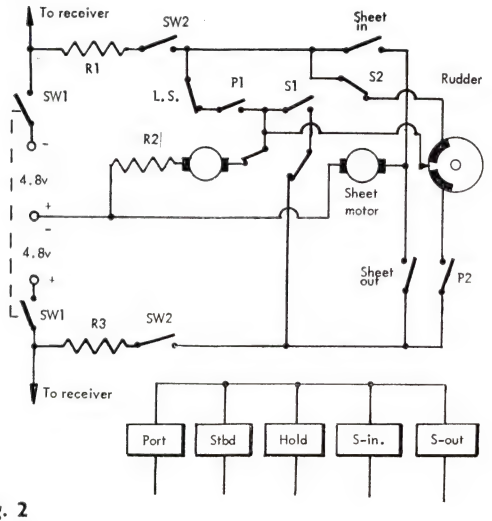


Fig. 2

The mechanical layout of the motors and gearing is shown in Fig. 1. The steering motor is fitted with a clutch as these motors have considerable inertia when brought to a sudden halt by the limit switch stops. The electrical circuit is shown in Fig. 2.

The various resistances included in the motor circuits and elsewhere; not only lengthen the life of the battery; but also help to maintain a higher average voltage at the receiver.

The test points are pieces of wire protruding from the board so that an earphone or meter can be

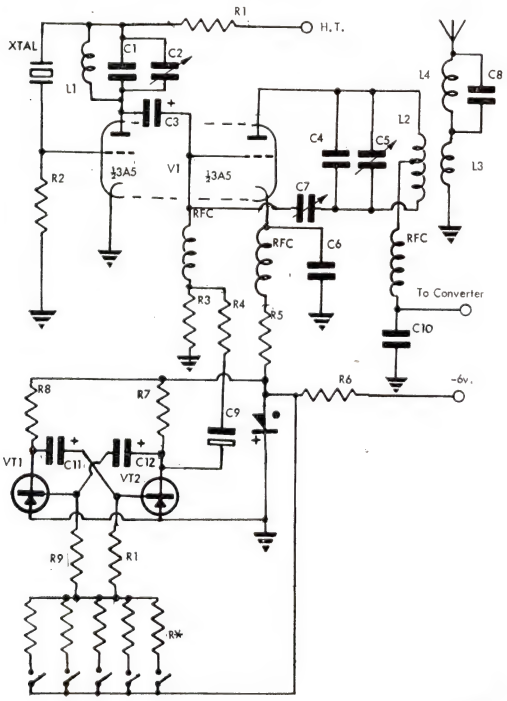


Fig. 3

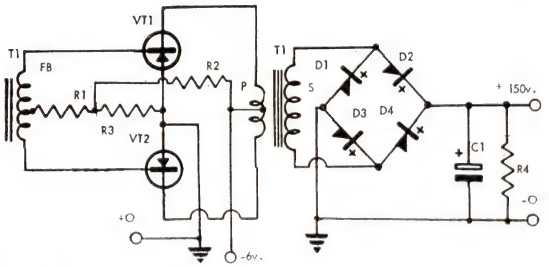


Fig. 4

TWO WATT CONVERTER

R1	: 100Ω	D1, D4	: OA210
R2	: 1200Ω	VT1	: AC128
R3	: 20Ω	VT2	: AC128
R4	: 300K	C1	: 4 μf Electrolytic

T1 : ½ sec. –312 t. 38 s.w.g. e.c.w.
Pri. –46 + 46 t. bifilar wound 27 s.w.g. e.c.w.
F.B. –12 + 12 t. bifilar wound 27 s.w.g. e.c.w.
½ sec. –312 t. 38 s.w.g. e.c.w.

clipped into the circuit. The Ferroxcube pot cores in the tuned circuits are type LA2500 which have adjustable slugs thus making it a simple matter to tune them accurately.

The Transmitter

The hand held transmitter consists of a crystal controlled oscillator feeding a neutralised amplifier. The tones are generated by a multivibrator which is

(*Continued on page* 321)

TRANSMITTER

R1	: 20K	C1	: 8 pf	C12	: .015 uf
R2	: 300K	C2	: 1-8 pf	VT1	: AC128
R3	: 50K	C3	: 8 pf	VT2	: AC128
R4	: 9K	C4	: 10 pf	V1	: 385
R5	: 25Ω	C5	: 1-8 pf	D1	: 5 v. Zenner
R6	: 10Ω	C6	: 680 pf	L1	:
R7	: 2K	C7	: 1-8 pf	L2	:
R8	: 2K	C8	:	L3	:
R9	: 10K	C9	: 1 uf	L4	:
R10	: 10K	C10	: 680 pf		
R*	: See below	C11	: .015 uf		

* Values of keying resistors.

Port rudder 1440 c.p.s. R in multivibrator	1300Ω
Starboard rudder 1610 c.p.s. R in multivibrator	3000Ω
Hold rudder 2400 c.p.s. R in multivibrator	4500Ω
Sheets out 2700 c.p.s. R in multivibrator	10000Ω
Sheets in 3450 c.p.s. R in multivibrator	12500Ω

As the transmitter was designed to work on 40.680 Mc/s the calculated values for 27 Mc/s have been included. The C values do not include the trimmers already specified.

Frequency—27 Mc/s; **L1**—11T of 20 c.w.; **C1**—15 pf; **L2**—12T of 16 c.w.; **C2**—15 pf; **L3**—2T; **L4**—14T of 18 c.w.; **C4**—3-30 pf.
Frequency—40 Mc/s; **L1**—8½T of 20 c.w.; **C1**—8 pf; **L2**—10T of 16 c.w.; **C2**—10 pf; **L3**—2T; **L4**—14T of 18 c.w.; **C4**—3.30 pf.

The coils L1 L2 and L3 are ½ in. internal dia. and L4 is ⅜ ID. All coils are stretched by 50 per cent to cut down their losses. L3 is made from nylex covered wire. This coil is pushed about ¾ into mesh at the centre of L2. There are no slugs in any of the coils. Ferroxcube cores type LA2500 are used in the tuned circuits in the receiver, and were wound with 500 turns of 34 G e.c.w. The inductance should be 200 mH.

The condenser values in the various tuned circuits are as below.

1440 c.p.s.	L = 200 mH	C = .05 uF
1610 c.p.s.	200 mH	C = .045 uF
2400 c.p.s.	200 mH	C = .02 uF
2700 c.p.s.	200 mH	C = .01 uF
3450 c.p.s.	200 mH	C = .008 uF

Polyester condensers are the best to use as they take up little room and have a high Q.

Single Transistor Stable Tone Generator

By H. N. GRIFFITHS

THIS article describes a single transistor oscillator which was designed to provide a stable source of tone for modulating an all transistor transmitter.

The oscillator circuit is a conventional transformer coupled feedback circuit providing a sinasoidal output suitable for feeding a high impedance load. The stability of the oscillator is of a high order and is suitable for reed type equipment by using the modified tuning circuit.

The heart of the circuit is the transformer which is wound in a Ferroxcube type 25 pot core (a large number of these were recently available on the surplus market at about 4/-)—Type LA1 is also suitable.

The transformer is of a 5:1 ratio:

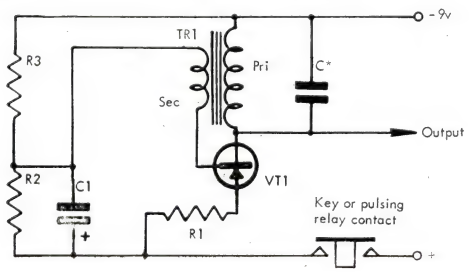
1,000 turns of 38 s.w.g. enam. wire are wound on the spool from the pot core to form the primary, covered with a single layer of Sellotape and followed by 200 turns of 38 s.w.g. wire as a secondary. It is advisable to carefully bare the ends of the windings and solder to 30 s.w.g. enam. lead out wires. These wires are anchored to the former with Evo-Stik to avoid putting strain on the transformer connections. The lead out wires are soldered to the tag board which forms part of the pot core assembly. The core can now be assembled.

A simple printed circuit was designed and made using the dry etch method of removing the copper between the lands with a sharp tool.

The order of assembly is as follows:

1. Solder R1, R2, R3, C1.
2. Solder VT1 using a heat shunt on the leads.

Fig. 1 **BASIC CIRCUIT**



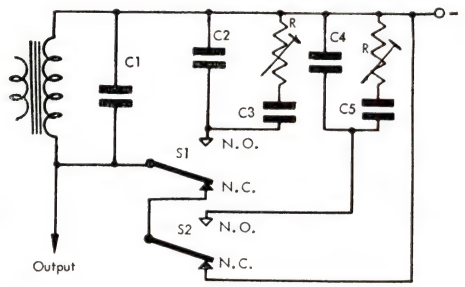


Fig. 2

C1 : 0.1μf
C2, C4: About 0.1-0.2μf (adjust to suit reed frequency reqrd.)
C3, C5: 0.05μf
R : 50k preset
S1, S2, etc., SPCO microswitch

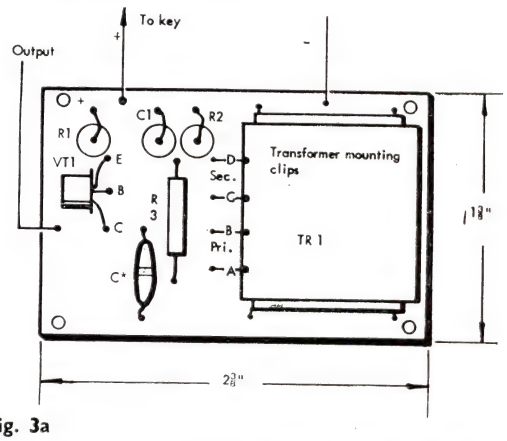


Fig. 3a

Components R1, R2, C1 are mounted vertically. Mounting of C" and spacing of holes depends on type available.

3. Solder four wires to the transformer holes A, B, C, D.
4. Place a small piece of foam rubber on the board and mount the trasnformer assembly on top. Solder the two tinplate clamps in place.
5. Connect the leads to the transformer primary and secondary. (Solder primary only at this stage.)
6. Solder the battery and output leads.

A high frequency oscillation should now be heard if the battery in series with an earpiece is connected to the oscillator. The frequency of oscillation is now lowered to the desired value by connecting capacitor

Component Values

R1 : 1k
R2 : 10k
R3 : 47k
C1 : 2μf
C* : About .01-0.5μf (see text)
VT1 : XB102
VR1 : Ferroxcube type 25 or LA1 (see text)
Wound 38 s.w.g. enam. wire :
PRI 1,000 turns
SEC 200 turns

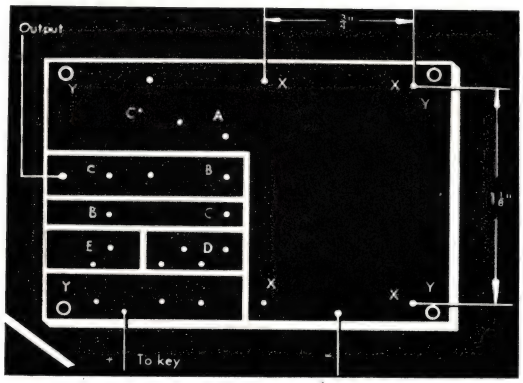


Fig. 3b Holes X $\frac{1}{16}$" ϕ
,, Y $\frac{3}{32}$" ϕ
All other holes No. 60 drill.

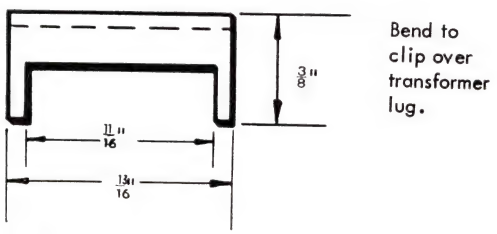


Fig. 4a

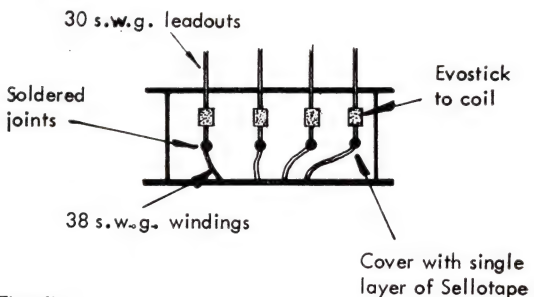


Fig. 4b

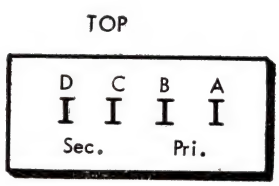


Fig. 4c

C across the transformer primary. The correct value is best found by experiment: a value of 0.1μf in the writer's circuit gave an oscillation frequency of approximately 1.2 Kc/s. If the oscillator fails to start reverse the connections to the transformer secondary: the secondary connections can now be soldered.

The oscillator is suitable for connecting to a modulator having a high input impedance, i.e., "Versatile" Tx, "Transmitter" or (as in the writer's Tx) "Easytran".

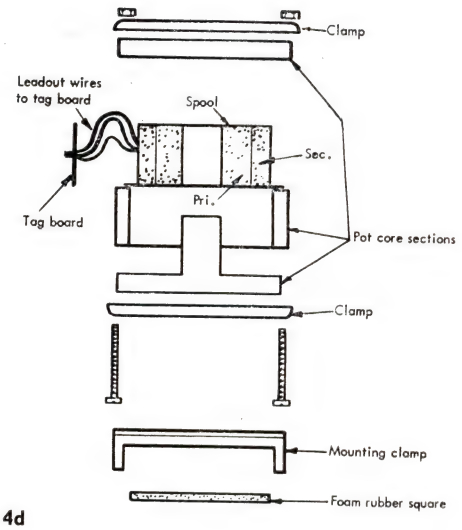
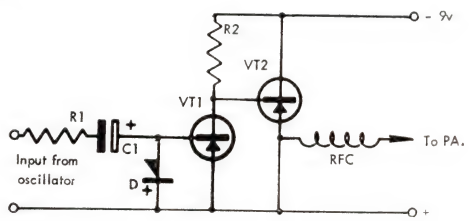


Fig. 4d

Fig. 5



R.C. YACHT

(*Continued from page* 319)

stabilised by a 5 volt Zener diode. The output grid modulates the output stage through a potential divider. Fig. 3 shows the transmitter circuit, and Fig. 4 the small converter for generating the high tension.

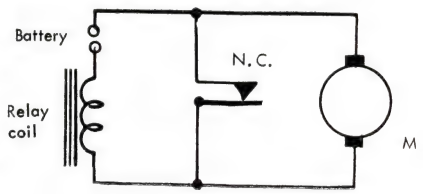
Operation

Once the boat has been balanced, tacking is very simple. The transmitter can be switched off once the sheets are adjusted and then the yacht will run true, as the self-centring rudder can be made to give a very accurate neutral. When going about it is only necessary to hold the button down until the main boom starts to swing and then released immediately. A perfect turn is accomplished without any yawing.

Running before the wind is a different matter. After making a turn, the sheets are payed out nearly 90 deg.; the yacht will be turning towards the running position. To obtain the maximum speed the jib is coaxed out the opposite side to the main sail. The steering becomes very touchy but a straight course can be achieved after sufficient practice.

A simple pressure operated pair of make contacts (see Fig. 1) prevents tangled sheets and is almost foolproof. The idea is that the sheets can only be payed in or out when there is sufficient wind to fill the sails.

Dynamic Braking For Servo Motors



A simple circuit to stop overrun by W. D. FOSTER B.Sc. (N.Z.)

Many R/C actuators which use electric motors suffer in some way or other from the effect of over-run after the motor is switched off. The simple arrangement described here will often effect a cure, and can greatly improve the reliability of motor-driven actuators.

MANY actuators which use electric motors suffer in performance because of the inertia of the motors themselves. This causes them to run on for some time after the current has been switched off, and has various harmful effects, depending on the type of actuator. The solution propounded here may have been described in the model press somewhere before, although I have not seen it myself. It was devised by Mr. Alex Ayton, who worked with me for some years, and who was then a keen modeller.

Disadvantages of Over-run

There are two ways of reducing the effects of over-run with a given motor. One is to add more gearing, and the other is to reduce the motor voltage. The first does not really cut down the over-run at all. It only reduces the effect of it, at the expense of slower movement of the final shaft. This may not be acceptable, because to reduce the over-run to reasonable proportions in this way often means that the control moves far too slowly.

Similarly, cutting down the motor voltage slows down the control, but it may have a more important disadvantage, viz., that of reducing the reliability with which the motor starts. This, if it happens, is entirely unacceptable, and it is largely because of these difficulties that motor-driven sequential type actuators were slow to become popular.

The kind of motor-driven actuator that duplicates the performance of the ordinary two-claw escapement, with its automatic return to neutral, usually works by means of a pair of wiping contacts, wired to the change-over contacts of the receiver relay, or by a cam-operated switch scheme. The two control positions are likely to be at any old angle to the line of the two neutral positions, and not 90 deg., as we would prefer. This does not matter very much, because it is still possible to arrange for equal rudder movements, and the over-run does not prevent the neutral positions of the output shaft from being at their statutory 180 deg. from each other. The trouble starts when the motor battery voltage drops, the motor speed drops, and the over-run becomes less. When this happens, we no longer have one neutral position, but two, because the line of the actuator neutrals changes direction, while the rudder linkage has been adjusted for the original neutral line.

With actuators of the progressive type, used with a pair of tones to give right or left at will, a self-returning-to-neutral feature is often provided, by means of wiping contacts on a lead-screw mechanism, or in some other way. The neutral zone has to be made wide enough so that the over-run of the motor does not take the homing contact past the gap, over to the other side. If this happens, the control oscillates permanently from one side of neutral to the other, without coming to rest at all. The cure for this is to make the gap between the homing contacts wider, until when they are just right for the amount of over-run of the system, it comes to rest at exactly the same spot, irrespective of the direction from which it neutralizes.

This is all very well, too, until the battery voltage drops, when the over-run reduces again, with the result that we acquire two distinct neutral positions, one of which is taken up when returning from "right" and the other, when returning from "left".

There is a further fault with this system, which makes it even more difficult to obtain an ideal neutral adjustment. It is that this time, the motor has to run in either direction, and it frequently happens that motors have different amounts of over-run, depending on whether they have been running in a clockwise or anti-clockwise direction.

All of this shows what a nuisance over-run can be, and why a good system of reducing it would be very helpful.

What to Do About It ?

Leaving out the unsatisfactory solutions of increasing the gear ratio and reducing the battery voltage, what can we do about it? The answer, which has been applied in some commercial actuators, is to apply braking to the motor. Some assistance can be had by a simple friction brake on the motor shaft. This is very wasteful of power, however, since it drastically reduces the output torque or force, and in any case is only in the nature of a "patch" rather than of a proper answer to the problem. It also reduces the "stability" of the motor, which can be fatal.

The best answer seems to be electrical or dynamic braking of the motor. This has no effect on the starting or running characteristics of the motor, since no braking action occurs until power is switched off from the motor. Indirectly, it can actually improve the starting characteristics of the motor by allowing us to operate it at a higher voltage than would have been possible without it.

The scheme is simplicity itself, and can be applied to any existing actuator simply by adding the relay and re-wiring the motor in accordance with the accompanying circuit. The relay does not need change-over contacts, but only a normally-made contact which opens when the relay is energized. When the motor is stopped, the relay is then directly across the supply when the motor is switched on. Now the coil is a low-resistance one, and if permanently connected across the battery would rapidly discharge it.

But as soon as the relay operates, the short is removed from across the motor, which then runs in series with the low-resistance relay coil. The only requirement to be met by the relay is that it must remain in its energized position when the current through it is reduced to that drawn by the motor. We now have the motor running. When the supply is cut off, the relay is de-energized, and its contacts close, short-circuiting the motor, which comes to a dead stop very rapidly. Those versed in electrical theory will recognise this as a neat application of Lenz's law, and is one which used to be found in every electric tram. In that case the braking effect was made variable by using a variable resistance instead of the short-circuit, the lower the resistance, the greater being the braking effect.

Suitable Relays

Fortunately, relays for braking circuits like this are very easily made. The small ones from Radiosondes are very suitable, since the main core with the bobbin can be removed for re-winding. This is no sort of a chore at all, because the low-resistance winding is only a relatively few turns of easily-handled wire about 20 s.w.g. The main difficulty about putting the scheme into practice is that of suiting the relay winding to the motor. The resistance of the coil should be as low as possible, consistent with the requirement that the running current of the motor must be able to hold it in. The armature must be very firmly held against the contact in the de-energized condition, because the contact resistance must be very low if the maximum braking effect is to be obtained. A strong return spring is thus indicated. This being so, the need for a small hold-in current can be met by allowing the armature to touch the pole-piece. It will not "stick" when the current is switched off, because of the strong return spring.

Those familiar with the ways of relays will recognise from what has been said that the requirements here are the direct opposite of those of a sensitive relay. The latter requires light return springing, and a fairly large gap between armature and pole-piece in order to bring the drop-out current as close as possible to the pull-in current.

If any difficulty is experienced in hitting on a suitable winding for an existing relay frame, it will be with motors that have a very low current consumption, for these will find it difficult to keep the relay energized enough. If, when faced with this problem, we wind on many turns of fine wire, the braking effect can be made satisfactory, but the *inductance* of the relay coil is liable to be so high that the motor builds up to speed only very slowly—and this cannot be tolerated. The correct procedure is thus as follows.

1 Adjust the armature stop so that the armature comes very close to, or even touches the pole-piece, provided only that the spring is strong enough to pull back the armature when there is no current in the coil.
2 Adjust the spring so that the armature returns positively after the relay has been energized. This can be tested by using the original coil, and applying enough voltage across it to operate the relay.
3 Re-wind the coil with a 20 s.w.g. wire, and connect up in the above circuit with the motor, its battery, and a switch. Using the switch to start and stop the motor, see if the system works. If it does, the job is finished.
4 If the system oscillates, so that the motor, when switched on, automatically starts and stops in rapid succession, re-wind the coil with wire a couple of gauges smaller, i.e., 22 s.w.g. and try again.
5 If the scheme works, but the motor takes a long while to come up to speed when switched on, re-wind the relay with wire a couple of gauges larger.

When you have it working, you can check just how effective it is by putting a piece of paper between the relay contacts, and switching the motor on and off. This will remove the braking effect altogether, and show up the difference between the two conditions in a very striking way.

Needless to say, the system can be applied to any motorized actuator except where the motor is pulsed rapidly on and off. The initial current drawn by the relay lasts for such a short time that it has negligible effect on the life of the battery.

COTSWOLD Rx

(*Continued from page* 303)

BLACK in 26 and 27, BLUE in 3.

( ) Carefully check all joints and make sure that there are no "solder bridges" between lands.
( ) Connect the RED wire to +3.6 v., one BLACK to one side of a 0-10 mA meter and the other side of the meter to −3.6 v. Current will be about 1.5 mA.
( ) Disconnect the meter, connect the BLACK wire to −3.6 v. and touch the earphone leads to the joints at 62 and 64: a roaring noise will be heard.
( ) Touch the leads to joints at 63 and 65 and the noise should be about the same level confirming transformer action.
( ) Connect the WHITE and other BLACK leads to the terminals of a low resistance escapement. Switch on the transmitter and key the tone. Rotate the tuning slug until the actuator operates, continue rotation until the actuator releases, then rotate back to the midway position. Range check the receiver.

Caution

Never operate the actuator for more than a few secs. at any one time: It draws high current and prolonged operation will damage the output transistor. This is a standard remark applicable to many relayless receiver.

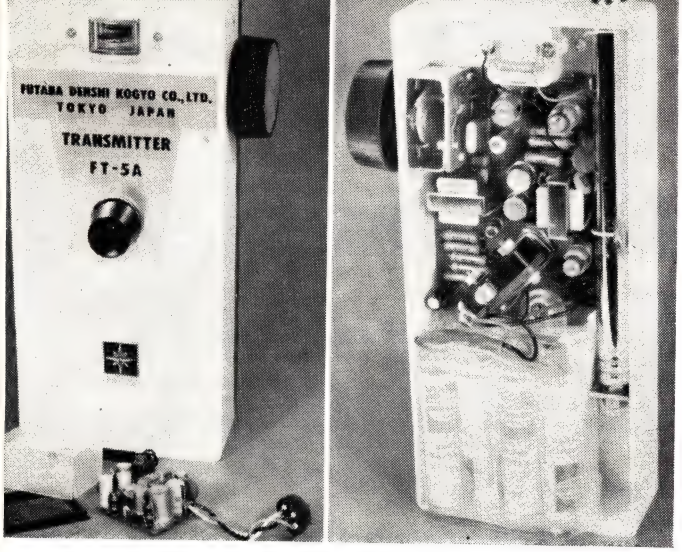
The tuning slug is rather loose in the former and should be secured with locking compound or a small piece of elastic alongside the slug.

Although the standing current is very low, it is advisable to put a switch in the RED lead. The receiver is best installed by wrapping in a piece of foam plastic and placed so that it has some freedom of movement in the fuselage: You will find it very "prang resistant". Any single channel system can be used but make sure that any relays or motorised actuators are promptly suppressed.

Test Figures (3.6 v.)

Total Rx current	No signal	Carrier only	Carrier and Tone
	1.5 mA	4 mA	400 mA (with 8 ohm coil)

If desired, tone and carrier may be transmitted together, there being no requirement for continuous carrier.



R.C.M. & E. Test Reports

EDITORIAL REVIEW & TESTS

- **FUTABA SINGLE CHANNEL Tx & Rx**
- **MODELECTRIC SINGLE CHANNEL Rx**
- **GRUNDIG SUPERHET Rx MODULE**

FUTABA Tx and Rx

FUTABA produce a number of radio control devices, a subject of the test this month is the single channel transmitter FT-5A, an all transistor tone device and the tiny F4-LR relayless 4 transistor receiver.

The equipment appears to be a "quality job" but the price of the Tx, at least, seems high compared with what we usually pay for Japanese R/C equipment.

TRANSMITTER

The transmitter is attractively presented in a slim blue and white plastic case complete with black leather cover. It looks a little like a domestic radio and a large rotary on/off switch and centrally placed keying button might well indicate that the case was originally designed for this purpose. No circuits were released and the example under test was without operating instructions. The whole of the transmitter circuit is on one p.c. panel and a separate battery clip plugs on to the supply leads and carries eight U7 cells to give 12 volts.

We particularly liked the light action microswitch, it certainly makes keying easy when using fast acting Japanese compound escapements. The button may either be tapped in the orthodox manner or held by the thumb, index and second finger and operated like a Morse key. The aerial is centre loaded and has a special coil built into the thickness of one of the tubes so that it is quite flush outside yet allows the aerial to retract through it's centre.

Heading photograph shows Futaba FT-5A Tx and F4-LR Rx, with inside shot of Tx, right. Battery pack is wrapped in polythene. Receiver, removed from its case, is shown below larger than full-size.

Physical Data

Size
$6\frac{3}{4}$ in. high x 3 in. wide x $1\frac{5}{8}$ in. thick.

Weight
$20\frac{1}{2}$ oz. including batteries.

Case Material
Polystyrene. Back retained by single captive screw.

Aerial
Nine section telescopic centre loaded $32\frac{1}{2}$ in. extended, retracts completely.

Construction
Printed circuit on $\frac{1}{16}$ in. resin paper laminate. Crystal controlled 27.120 Mc/s five transistor circuit.

TEST FIGURES

Currents
12 volt input.

Aerial extended
Carrier 40 mA.
Tone 82 mA.

Aerial retracted
Carrier 54 mA
Tone 105 mA

Modulation
Square wave 420 c.p.s.

Approximate Output
Comparative field strength reading indicates a carrier radiation of about 100 mW.

RECEIVER

This is a 4 transistor circuit with 2 transformer couplings and is tightly packed on to a $\frac{1}{32}$ in. glass epoxy p.c. board. A tuning indicator lamp apparently similar to the Otarion receiver, has been incorporated in the output stage and is easily visible through the nylon cover. A polystyrene bottom panel protects the copper side of the p.c. board and is simply taped in place. The receiver has a very short harness terminating in a 3 pin curved plug and matching socket, which assures correct polarity. Unfortunately the direct soldered connections to the plug are easily fatigued after a number of "pluggings and unpluggings". We always deprecate unsupported joints, and would not use the plug in a model as received. The solution would be to file a groove in the side of the plug, double the wires back and bind them securely in place. Strange . . . the manufacturer has carefully secured the wires at the receiver end and glued all the components together to make it crash resistant.

The receiver is intended to operate from two pen cells, it will also operate from slim pen cells, but here it would be better to use the high performance types (Ever Ready U16-H). We found that when operating cascaded compound escapement sets results

were far more positive with a 3.6 DEAC, this is, however, defeating the idea of using a sub-miniature receiver which is really intended for tiny models with a simple 2P, 2N escapement.

Physical Data

Size
$1\frac{1}{4}$ in. x $1\frac{1}{16}$ in. x $\frac{3}{4}$ in.

Weight
$\frac{3}{4}$ ozs. including plug and socket.

Harness
Receiver supply and output wire 2 in. long.

Aerial
27 in. long.

Construction
Single $\frac{1}{32}$ in. glass epoxy board all components vertical and bonded together.

TEST FIGURES

Currents
3 volts in 10 ohm escapement:

No Signal
It was not possible to measure the receiver under this condition, as the current fluctuated violently.

Carrier
1 mA.

Tone Signal
250 mA.

Sensitivity
Approx. 4μV.

AF Response
Between 200 and 1.8 Kc.

Peak Response
1100 c.p.s. even though the Tx was checked at 420 c.p.s.

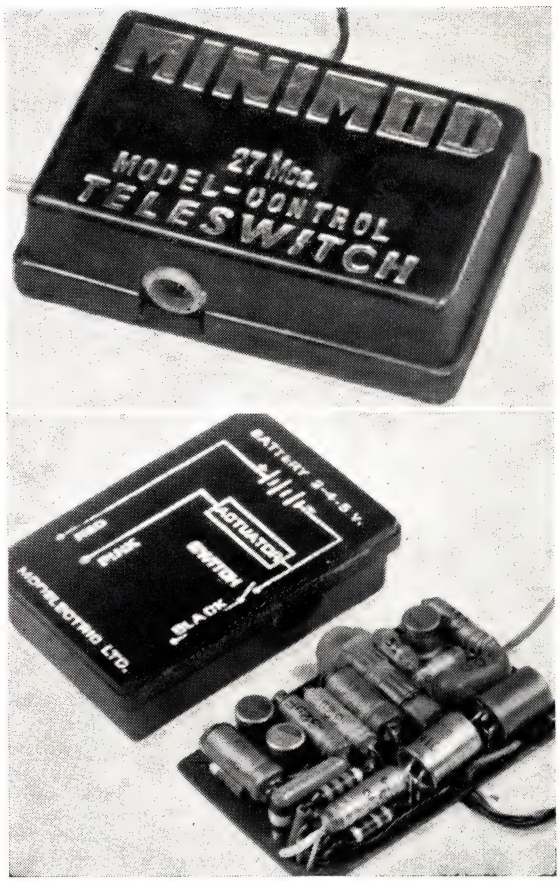
Stability
Voltage was reduced to 2 volts, receiver still operated at much reduced sensitivity but would not drive escapement. Minimum voltage for safe operation 2.6 v.

Temperature stability
Slight loss of sensitivity below 35 deg. F.

Interference
The receiver does not swamp, a noisy electric motor was brought within 3 in. of the receiver of its leads before interference triggered the escapement. A "clean" electric motor could be operated in contact with the receiver, harness or aerial. The receiver was not suitable for operating relayless motorised actuators direct.

Manufacturer
Futaba Denshi Kogyo Co. Ltd., Tokyo, Japan.
Sample obtained from Watford Model Exchange, St. Albans Road, Watford.

Prices
Tx: £18.13.0d. Rx: £7.17.0d.



Minimod cased, and shown removed from case below. The lower photograph is approximately full-size, note the wiring diagram on the bottom of the case.

MODELECTRIC MINIMOD Rx

THE Minimod is a tiny, fully enclosed super-regen relayless Rx. The circuit has been changed somewhat from the earlier Modelectric Rx the transformer less relayless design tubular configuration to a wafer-thin subminiature layout with all components laid flat. The receiver fits into a plastic case with protective plate to cover the p.c. board. This plate carries a wiring diagram which shows a typical escapement connection. The receiver was tested with 10 ohm escapements, Mighty Midget motors on manual pulse and the Modelectric relayless motorised actuator.

This receiver represents considerable improvement over the popular tubular device marketed earlier by Modelectric. It does not need carrier to hold the idle current down between tone signals although the Modelectric Tx does radiate carrier. Naturally, with carrier to block interference, performance is more consistant in busy areas. Tests show that the receiver is not prone to intereference from the average servo motors and similar drive motors in models. The Minimod has the additional name "Teleswitch" the point of which escapes us, however, the test figures speak for themselves.

Physical Data
Length $1\frac{3}{4}$ in.
Width $1\frac{1}{8}$ in.
Depth $\frac{1}{2}$ in.
Weight $\frac{1}{2}$ oz.

Harness
Three colour coded wires 5 in. long, no plugs or sockets (the receiver is intended to be wired direct, saving weight on small models).

Case
Red translucent nylon with black cover plate, tuning access through edge of case.

TEST FIGURES

Currents	3 v.	3.6 v.	4.5 v.
No signal	9 mA	15 mA	18 mA
Carrier	9 mA	15 mA	18 mA
Tone	230 mA	300 mA	315 mA

measurements are total current using a 10 ohm escapements. Additional tests with Mighty Midget motor in place of escapement resulted in a total stall current of 350 mA, the output transistor did not overheat (3 v. used). This special output stage will pass 500 mA.

Sensitivity
Better than 4 μV.

Tone Range
350 to 1500. Square wave.

Peak
Response at 800 c.p.s.

Interference
The Rx was not affected by worn Kako motors in contact with the aerial even with carrier off. A Mighty Midget motor wired in place of an escapement cut cleanly when the signal was terminated. The receiver was naturally affected by other transmitters as the tuning is fairly broad.

Temperature Stability
The Rx was heated to 120 deg. F. and cooled to 32 deg. F. slight loss of sensitivity was experienced at the low temperature end of the scale.

Batteries
We recommend 3.6 v. DEACs as an economical power supply in the average sized model. One might think a 4.5 v. dry battery gives a more consistent escapement performance but 3 v. dry batteries are still adequate for normal flying.

Summary
One of the neatest and lightest miniatures tested today; slipped into a slit in a piece of sponge plastic this Rx offers a reliable operation for the smallest aircraft, and has the advantage of being capable of driving a powerful motorised actuator (sequential relayless) for heavier models.

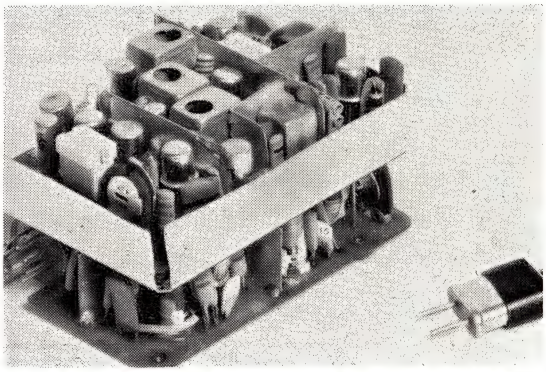
Manufacturer
Modelectric, 2 Hanover Gardens, London, S.E.11.

Price
£8.17.6d. A kit version which is caseless on a baseboard $2\frac{5}{8}$ in. x $1\frac{1}{2}$ in. is available price £5.9.6d.

GRUNDIG SUPERHET

To fill the modern need for superhet equipment Graupner have produced a Grundig "Varioton S" available in the following frequencies 26.975, 27.098, 27.120, 27.142 and 27.265 Mc. per second. The new receiver is used in place of the standard super-regen unit and plugs on to the usual stack of relay filter modules. The receiver is the same cross section but double decked, bringing the depth to $1\frac{1}{2}$ in. Much internal screening is used and the construction is on glass epoxy p.c. panels. It was not possible to desemble the unit under test as this is factory sealed however, the accompanying photograph by the manufacturer shows the construction.

The receiver was tested with a Grundig 4 Tx which had also been converted by means of the 4 channel adaptor to an 8 channel device. Alignment is apparently unnecessary when changing to any of the 5 spot frequencies previously referred to. In each case the crystal pair are supplied matched and plug into sockets accessible through the case.



Manufacturer's photo of the "Varioton S" showing the extensive screening and two deck construction. The crystal is seen right.

The standard Grundig super-regen and 8-channel Tx were reviewed in the December 1962 issue.

PHYSICAL DATA

Size
$1\frac{1}{2}$ in. x $2\frac{1}{8}$ in. x $1\frac{1}{2}$ in. deep (flanged base $\frac{1}{16}$ in. over first two dimensions).

Weight
$2\frac{1}{2}$ ozs. one input, two output sockets, one crystal socket. Whole unit designed to fit standard Grundig filter modules.

TEST FIGURES

Currents
6 v. supply.
No signal 18 mA.
Carrier 18 mA.
Tone 19 mA.
One filter operating 40 mA total (the 19 mA figure was obtained by transmitting one of the other tones but not using the appropriate filter module for that tone).

Sensitivity
Approximately 2 μV.

Interference
The receiver was unaffected by several other crystal controlled transmitters of other makes for frequencies adjacent to the example under test.
The receiver was unaffected by electric motors which were reasonably well suppressed, unsuppressed Mighty Midget motors and multi servos of well known manufacture.

Stability
Tx and Rx were cooled to approximately 32 deg. F. and heated to approximately 120 deg. F. with no apparent change in performance.
The receiver voltage was reduced to 4.8 with corresponding reduction in sensitivity. The receiver would not work below 3.6 v.

Manufacturer
Jahannes Graupner, Kirchheim-Teck, Germany

Price
£29.10s.

Commercial Developments

CONSUMER STAFF MEMBER TONY DOWDESWELL SAMPLES NEW PRODUCTS AT HOME & ABROAD

In as much as last month's Commercial Developments could be considered a "proportional issue", this month's column is concerned very much with kits—aircraft kits, servo kits, even fuel tank kits. One of the odours that bring joy to the heart of the modeller is the whiff of dry wood present when a new model kit is opened, and at the moment, the office fair reeks with it—lovely !

New from Keil Kraft

Long awaited introduction from Keil Kraft is their **Mini Super**, a 48 in. span scaled down Super 60 for single channel radio and 1.5-2.5 c.c. motors. Unlike the big "60" though, the Mini Super has a tricycle undercarriage and is altogether a very attractive aeroplane which should prove very popular with "grass field" fliers and especially beginners, for whom the high wing layout will be suitably forgiving of misapplied control.

The Mini Super is not difficult to build and is a well executed kit with a good level of pre-fabrication and excellent quality wood in the sample received. Extras included in the kit are metal fuel tank, ready formed engine plate, shaped coil sprung nose leg and dural leaf type main undercarriage plus a set of wheels.

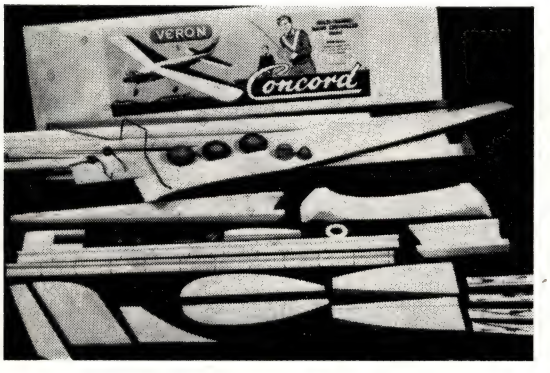
The test kit went together very quickly with no special construction problems. During test flights, the model was equipped with Kraft K3VK receiver driving a relay to switch O.S. single channel motorised actuators for rudder and throttle control, all towed aloft by O.S. Pet .09 (1.6 c.c.) power. During test flights our model absorbed a considerable amount of rough and tumble treatment which it survived, although showing up a weak point at the front of the cabin area. Price for the Mini Super is £4.10s.

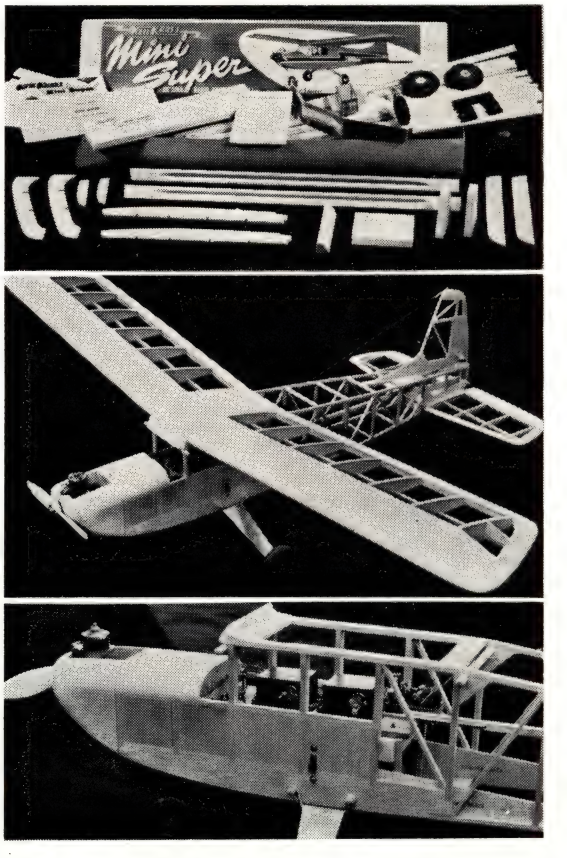
Veron Concord

The latest Veron introduction, which swells their range of R/C kits is the **Concord** which should please multi fliers with its attractive lines. This shoulder wing aircraft with tricycle undercarriage, long "turtledeck" fuselage topside, low set tailplane and raked fin cannot fail to remind any conversant multi enthusiast of the "Stormer". No matter say we, this is an ideal layout for the average flier and likely to be very popular. With six channels and a .35 cu. in. motor (four if you sacrifice throttle control) the Concord makes a fine trainer, but will also carry full 10 channel equipment with up to 10 c.c. powerplants.

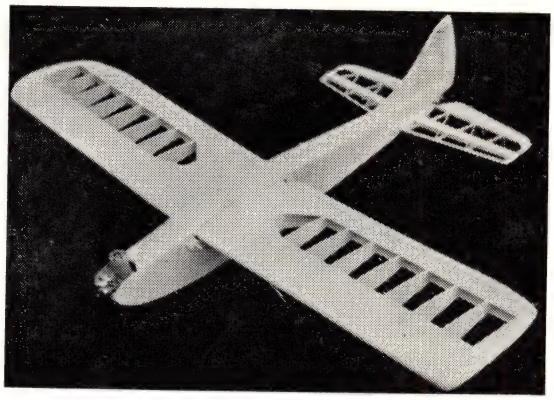
The Concord spans 66 in. and is 52 in. long. The wing chord of 12½ in. including 1¼ in. wide strip ailerons gives an approximate effective wing area of 780 sq. in., enough for full aerobatic performance up to about 7 lbs.

This is an excellent example of kitting, with a very high level of prefabrication and quality. Ribs, fuselage sides, wing tips, fin and rudder assembly engine bay side cheeks, strip ailerons and elevators are pre-formed, while wing leading edges are spindle moulded and notched for the wing ribs. The top deck is a three part spindle moulding for the tank





Below : Veron Concord kit, showing very extensive level of prefabrication. Note moulded top deck, wheels and spinner provided. Left: Keil Kraft Mini Super kit is well prefabricated with plenty of hardware. Airframe structure follows closely earlier Super 60 model. Our test model is equipped with O.S. single channel servos shown at bottom.



Above: American A-Amco H-Ray kit is very extensively prefabricated as can be seen here. Note full length fuselage sides, ready cut formers, shaped blocks, and shaped undercarriage. Right: Aviette's President kit builds up into sturdy airframe. Ours is destined for Orbit proportional equipment.

hatch, wing fairing and rear top deck.

Plenty of hardware makes the kit very complete. There's ready formed main and nosewheel undercarriages (noseleg non-steerable), wheels, spinner, nylon control horns and five adjustable K-Link, micro adjustment clevises.

So far our test kit is three quarters complete and likely to have flown by the time you read this. So it is too early yet to make any comment except concerning the single wire leg main undercarriage, which experience with more than one model has shown this pattern may be inadequate. An extra wire strut which can be conveniently formed and added to the existing undercarriage will ensure good "hit-and-stick" landings. The $\frac{3}{16}$ in. ply engine plate too, we would have thought inadequate for the engines it is required to mount. In all other respects though, Veron's Concord is a winner, the prototype of which impressed the editor when flown by Peter Cabrol at the R.C.S. Model Park, Woburn Abbey. Price £11.15.6d.

Box-Lok Construction

The demands of today's modellers incite kit manufacturers to greater efforts on prefabrication and simplification with each new introduction.

A new name in the model kit industry is the American **A-Amco** Company who have marked their entry into kit production with two very highly prefabricated sport R/C kits which embody what is termed **Box-Lok** construction, of which more in a moment. The two kits are the **H-Ray,** a 50 in. span, 425 sq. in. high winger and a similar shoulder wing **S-Ray.** H-Ray is intended for 1.5-2.5 c.c. engines, while the S-Ray suits 1-1.5 c.c. motors.

Our sample kit, direct from U.S.A. was the H-Ray, and this kit embodies a tremendous amount of prefabrication, so that it is in fact possible to assemble the fuselage in your hands with rubber bands. That, in a nutshell describes Box-Lok construction!

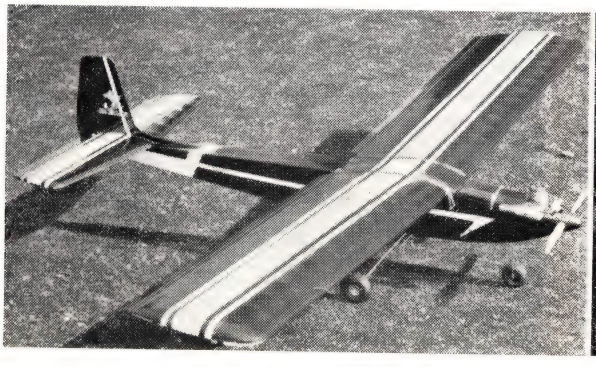
Equipment bay sides are channelled, allowing insertion of bulkheads to suit permutation of equipment installation, details of which also covered in a large picture sheet which shows just about every possible radio system any modeller is likely to install. We will in fact go further and add that the H-Ray comes closest yet to the kit with which the beginner, having no previous building experience, could enter the R/C field. To be sure there was a battle in the office for the custody of this one but alas, your scribe did not win!

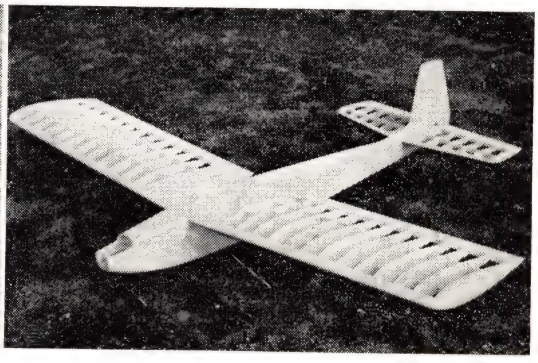
A-Amco kits are distributed by Ripmax Model & Accessories. The H-Ray costs £7.19.6d. and the S-Ray £6.19.6d.

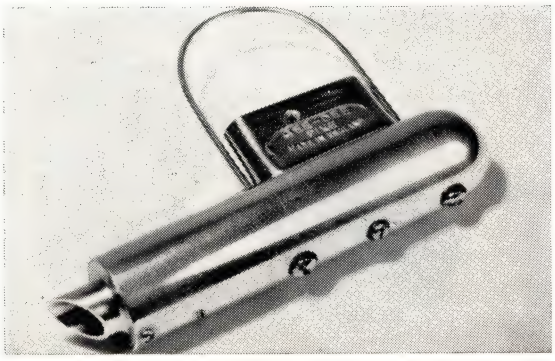
Goldberg Sr. Falcon flies—and dies

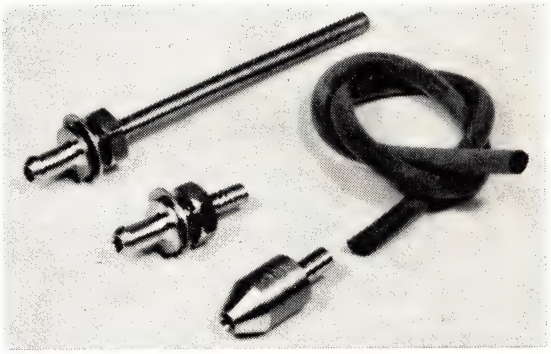
The Goldberg Senior Falcon first mentioned some months back gave us a great deal of pleasure both in construction and flying. We found construction remarkably easy, requiring a minimum of effort and discovered only two black marks; one for the wing centre section sheeting, which did not accurately key with the wing ribs as intended. The second point concerns the main undercarriage legs which are single struts. These are another example that were not sufficiently stiff for non-bounce landings and in

Our Goldberg Senior Falcon was finished in polychromatic blue and white. Colours on bottom of wings are reversed—white round edges. Model equipped with Orbit 10, Bonner servos and Merco 61 weighed 7 lbs.









Left: The New Gee Dee Pike Competition Silencer. Prominent external difference from earlier pattern is the retaining strap. Above: C & L Developments' Clunk Tank Kit. Bottle tank supplied by customer to suit his own requirements.

fact proved to be a very effective catapult system. They were quickly removed and replaced by a twin strut unit with a strainer between the axles. After this, landings were excellent.

The Senior Falcon is an excellent and forgiving model with good aerobatic performances at 7 lbs. all-up weight, although at this weight, we feel a 10 c.c. motor is desirable. We enjoyed outside loops and rolls from inverted position, but alas came to grief while messing about low down. . . . Never again! Roland Scott Ltd., has the Sr. Falcon. Price £11.18s.

Aviette President

One more *R.C.M. & E.* test model almost ready to take the air is the Aviette President which went together with only a few minor snags in die cutting errors. The airframe is tough and well able to absorb the rough and tumble it might receive at the hand of the multi beginner.

More comment on the President will follow when it eventually appears at the local flying field equipped with Orbit Proportional gear..

Clunk Tank Kit

C. & L. Developments Ltd. have introduced a **Universal Clunk Tank Kit** comprising air vent, fuel vent, fuel pick-up pipe and "Clunk" weight. As the name implies, the kit may be used with any polythene bottle, which the modeller supplies himself and for 4/11d. will please the economy minded types.

New Gee Dee Pike Silencer

The Gee Dee Pike Silencer first mentioned in our March edition has been supplemented by a range of **Gee Dee Competition Silencer** units. The new Competition Silencers will suit the Merco 49 and 61, while a converter adaptor will be available to enable the unit to be used with Super Tigre .56 and .60 power plants.

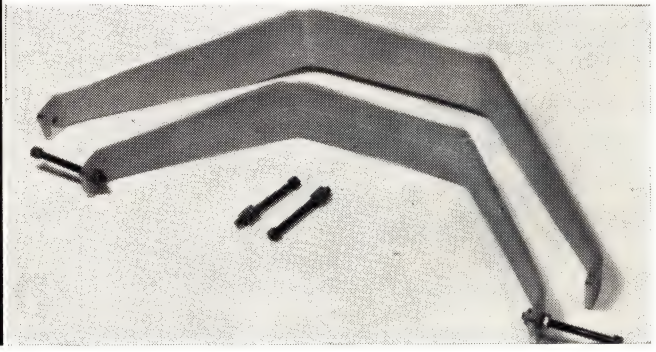
Main external feature identifying the new unit is the $\frac{3}{32}$ in. stainless strap, which passes completely through the silencer body and is retained by two hollow screws. Threads are rolled on to the strap after it is passed through the body (raising the thread by 0.010 in. and thereby preventing the silencer from parting company with the engine even if the screws fall off.

Other changes include re-design of the tailplane assembly and a new adaptor made from aluminium with a priming hole that directs the fuel straight into the cylinder. The Merco 49/61 unit will cost £3.2.6d. and the Super Tigre unit 2/6d. more. A shortened version for Merco 29/35 and McCoy 29/35 motors will also be available shortly price £3.2.6d.

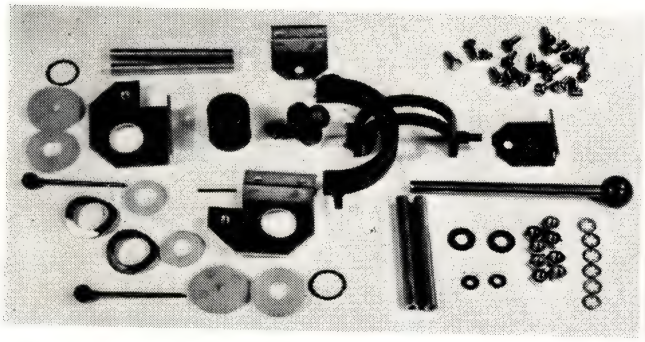
The manufacturers claim virtually no power loss whatsoever for the Competition unit, which they say runs far cooler, but saves 10 per cent less fuel than the standard unit. Weight, including strap is a little over 2 oz.

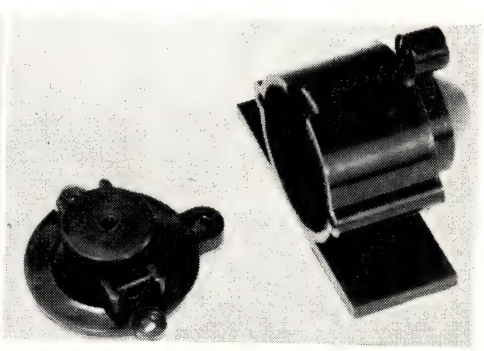
More Clunk Tanks

C.S. Developments **Multi Master Clunk Tanks** are available in 2, 4, 6 and 8 oz. sizes costing 5/4d.,



Left: C.S. Developments' Clunk Tanks, available in 2, 4, 6 and 8 oz. sizes. Cap has single vent and two air vents in body of tank. Below C.S. dural undercarriages with high tensile steel bolts for axles. Stiff dural will not easily distort.





Above : Kit of parts for Min-X proportional control stick assembly. Top right: Nylon case for popular Mighty Midget electric motor. Both items available from Peter Waters at Min-X Service Centre. Right: Kurt Bauerheim who placed third in R/C at last year's West German Nationals displays new German Multiplex 101 proportional system. German Krik kit model in foreground.

5/10d., 6/11d., and 7/11d. respectively. Each has a single cap vent for the fuel line and two air/filler vents in the translucent polythene body.

Another C.S. line is a **pre-formed duralumin** undercarriage formed from $\frac{1}{8}$ x $1\frac{1}{2}$ in. extruded duralumin stock and supplied with high tensile steel axle bolts. Two sizes are available, the smaller, with 9 in. track suits models up to 45 in. span and costs 8/4d. plus 1/- post and packing. The larger size with 11 in. track suits models over 45 in. span and costs 9/8d. with similar post and packing charge.

Nylon Mighty Midget Case

Ever had a mighty Midget case break? We have more than once. Peter Waters has nylon Mighty Midget Cases imported from U.S.A. They are virtually unbreakable and are worthwhile replacements. Price 16/-.

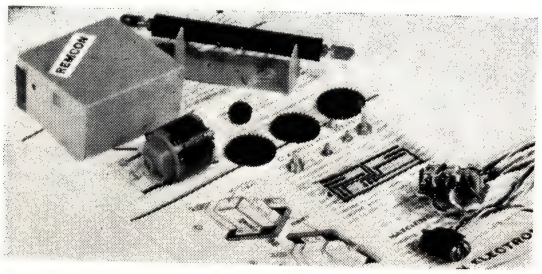
Proportional Control Stick Assembly

Another import available from Peter Waters is the **Min-X Control Stick Assembly** as used on the Min-X Pulsemite transmitter tested in our March edition. The Control stick assembly is supplied in kit form and includes all components except pots which the purchaser supplies himself to suit his individual system. The unit goes together on a four piece metal form, the main control column engaging with a double yoke assembly moulded in nylon which transmits movement to the control pots. Trim controls are also provided. Price is £6.10s.

Remcon Servo Kit

Remcon Electronics are offering a **multi servo kit** which should have appeal to the "multi-on-a-budget" types who have to count the pennies carefully. Con-

Components for Remcon servo kit displayed with building instructions. TASA amplifier shown at bottom left are mounted externally.



struction is not difficult at all, involving installation of motor, three spur gears, rack and pinion output, and switcher plate, plus external TASA type amplifier working on a common untapped 6 v. DEAC for relayless version. Servo case size is 2 x $1\frac{3}{4}$ x $\frac{7}{8}$ in. and the relayless version weighs $1\frac{3}{4}$ oz. Prices are £2.19.6d. and £6.9.6d. for relay and relayless units respectively.

Clanger

Caption on page 280 last month concerning the Kraft digital proportional system read "Thus eliminates number of components necessary". Operative word should have been "reduces", because the Kraft system has no failsafe mode in the event of interference and loss of signal. The elimination of the failsafe mode considerably simplifies the system and thereby the number of components necessary is reduced.

COTSWOLD

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July MODEL CARS

Sebring winner glamorous Chaparral, Ferrari 330 LM GT and Iso Grifo A3C, all exciting Prototype Parade Plans. Chaparral on the cover . . . Colours of the Private Teams—a new series . . . Ladder type Space Frame for Pittman 196A. Joining Metals by Tom Nelson . . . Real Gear Changing—latest American Novelty, plus all the popular features Trend of the Trade; Readers' Letters; Clubs News.

First Friday in the month 2/6d.

June MODEL MAKER

Filling a long-felt want will be a drawing of one of those ornate Mississippi stern-wheel, twin-stack paddle steamers; the plans, which will be available separately, are for a 33 in. model in the expert category. Supporting articles include how to go about R/C steering and straight running without radio, plus the usual wealth of drawings of interesting vessels and other useful articles.

Fourth Friday in the month 2/6d.

June AEROMODELLER

1965 sees the 25th anniversary of the "Battle of Britain". Since we have already produced features on the famous Hawker Hurricane and Supermarine Spitfire as well as the Focke-Wulf 190, it is only natural that attention should now be turned to the famous **Messerschmitt Bf 109E.** Doug Carrick, noted specialist on the type, has prepared a drawing which is the result of thousands of hours of research. Direct measurements taken off remaining aircraft and information from maintenance manuals enabled him to establish the true shape of this aeroplane in every respect. Sketch details will cover many hitherto little understood features. **Slope soaring** is becoming more and more popular. As the summer season gets under way, a special feature is introduced on the subject in general together with drawings for a quite simple but very good 36 in. span solid wood slope soaring design. **New silencers** are about to be introduced and a survey together with test appraisal will make interesting reading. So, too, will the latest book reviews, contest designs and general features for all modellers in the June edition on sale May 21st.

Third Friday in the month 2/-

CLASSIFIED ADVERTISEMENTS

RADIO controlled, all electric "Sea Queen", including 10 channel crystal controlled transmitter and crystal controlled superhet receiver, fully transistorised. As new perfect condition £35 o.n.o. 24 Field Cottage Drive, Oldswinford, Stourbridge, Worcs, or phone Stourbridge 5993.

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FOR SALE: MacGregor transmitter—single channel, Emco receiver, two escapements, as new. £12 complete. Apply: B. Gee, 106 Oxford Gardens, London, W.10. Ring: Ladbroke 0241.

LATEST R.C.S. Competition Special, 5 servos, DEACs, charger, £70. Hardwick, Park Road, Raunds, Northants.

URGENTLY REQUIRED: Modeller with R/C experience to build American kit. Time factor important. Gunter & Knight Ltd., 30 Lady Bee Yard, Southwick, Essex.

COMPLETE OUTFIT ready to fly, Min-X Powermite 6, superhet combo, 3 amplified Duramites on de luxe installation board, DEACs and charger, virtually new. £55. M. F. Davies, 236 Parchmore Road, Thornton Heath, Surrey.

8 CHANNEL transmitter chassis, pot board, and case to match. Built to 'Duo Ten' circuit, well made, no rubbish. £7. R. Capewell, 38 Cintra Park, Upper Norwood, S.E.19.

RADIOMODELS new address: "Modelradio", opposite Crystal Ballroom (1 George Street), Newcastle-under-Lyme, Staffs, on the M.6. See advert.

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MIN-X Ten Channel outfits, only £8 deposit. O.S. Minitron Ten and Kraft Ten £10 deposit. See "Radiomodels" advert.

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CITIZENSHIP Ten Channel Contest Outfit at £8 deposit: see Radiomodels advert. S.A.E. for comprehensive lists, etc.

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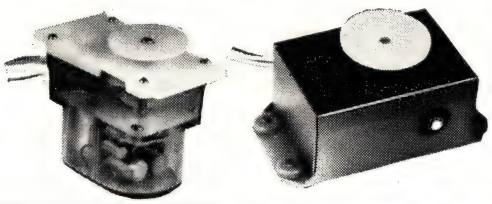

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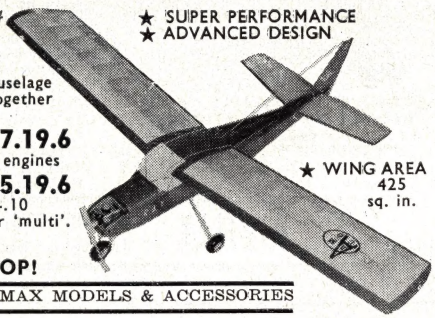

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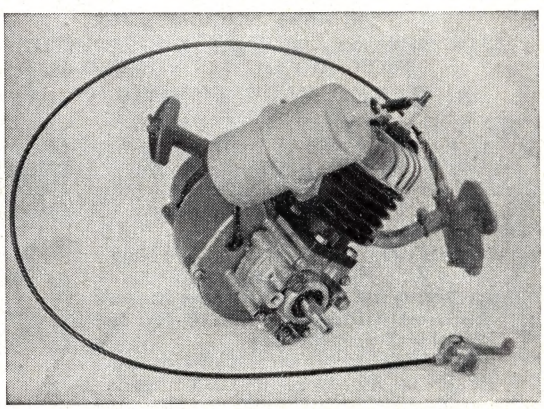

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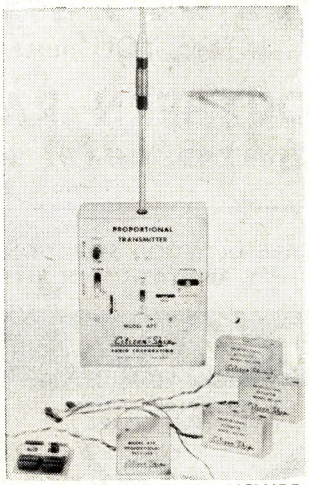

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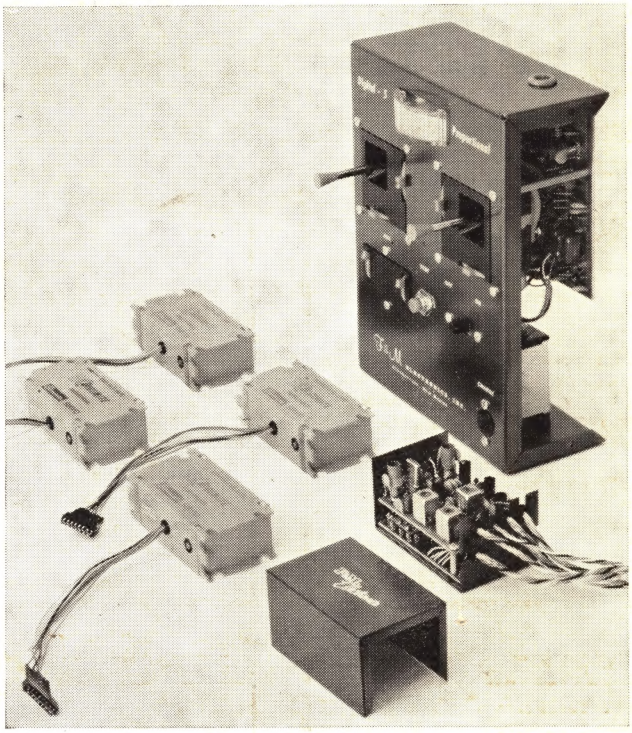

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